The New York, West Shore and Buffalo Railway, and the Methods Used in its Construction.*

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(*Concluded from page 161.*)

In calculating stresses the length of span is taken as the distance from center to center of pins for trusses, and between the centers of bearing-plates for all beams and girders. Where members are subjected to a bending stress from local loadings, in addition to the stress due to their positions as members of the structure, they are specified to be proportioned to resist the combined stresses.

The rivets and bolts in the structures are so spaced that the shearing-stress per square inch shall not exceed 6,000 lbs., nor the pressure upon the bearing surface exceed 12,000 lbs. per square inch of the projected semi-intrados, or diameter by thickness of piece, of the rivet or bolt-hole.

The specifications contain the following stipulations regarding riveting: —

(1.) The rivets will generally be $\frac{3}{4}$ in. or $\frac{7}{8}$ in. in diameter.

(2.) The pitch, in all classes of work, shall never exceed 6 in. nor sixteen times the thickness of the thinnest outside plate, nor be less than three diameters of the rivet.

(3.) The distance between the edge of any piece and the center of a rivet-hole must never be less than $1\frac{1}{4}$ in., except for bars less than $2\frac{1}{2}$ in. wide; when practicable, it shall be at least two diameters of the rivets.

(4.) In punching plates, the diameter of the die shall in no case exceed the diameter of the punch by more than $\frac{1}{16}$ in.

(5.) Whenever possible, the rivets must be machine-driven.

(6.) All joints in riveted work, whether in tension or compression-members, must be fully spliced, as no reliance will be placed upon abutting joints. The ends, however, must be dressed straight and true.

Pins are so proportioned that the shearing-stress on them shall not exceed 7,500 lbs. per square inch, nor the crushing stress per square inch of projected semi-intrados be greater than 12,000 lbs., nor the stress due to bending greater than 15,000 lbs. per square inch when the centers of bearings of the stressed members are considered as the points of application of the bending forces. The diameter of the pins is not less than two-thirds of the largest cross dimension of any member attached to them, and they must be turned smooth and fit within $\frac{1}{50}$ in.

Plate-girders are proportioned upon the supposition that the "bending or chord" stresses are resisted entirely by the upper and lower flange, and the shearing stresses resisted entirely by the web-plate.

The compression-flanges of beams and girders are stayed against transverse crippling when their length is more than thirty times their width, and the unsupported width of any plate subjected to compression never exceeds thirty times its thickness. The iron in the web-plates is proportioned to have a shearing stress not greater than 4,000 lbs. per square inch, and no web-plate is less than $\frac{1}{4}$ in. in thickness. No rods of less section than $\frac{3}{4}$ sq. in. are allowed for use as lateral or diagonal members. When the height of the trusses of "through" bridges is over 25 ft., overhead diagonal bracing is used. In all deck-bridges diagonal bracing is provided at each panel. In double-track bridges the diagonal bracing is proportioned to resist the unequal loading of the trusses.

All bed-plates are of such dimensions that the greatest pressure on the masonry does not exceed 250 lbs. per square inch, and they vary from $\frac{3}{4}$ in. to 2 in. in thickness.

Bridges of more than 50 ft. span have at one end nests of turned friction rollers, formed of wrought-iron, and running between planed surfaces. The rollers are not less than 2 in. in diameter, and are so proportioned that the pressure per lineal inch of roller does not exceed the square root of the diameter in inches, multiplied by 500 lbs. ($500\sqrt{d}$). Bridges less than 50 ft. in span are secured at one end to the masonry; the other end is left free to move by sliding on planed surfaces. A variation in temperature to the extent of 150° is provided for throughout.

All bridges are given a camber, by making the panel length of the top chord longer than that of the bottom chord, in the proportion of $\frac{1}{8}$ in. to every 10 ft.

The specification for iron used on the West Shore Railway is similar to the one originally drawn up for the Cincinnati Southern Railroad. The same specification was adopted for the New York Elevated railways, and is as follows:—

(1.) All iron must be tough, highly fibrous, and uniform in texture. In its manufacture no old or scrap-iron is to be used. Test-pieces, selected at random by the engineer from any iron designed to be used for this company, shall show a minimum ultimate tensile strength of 50,000 lbs. per sq. in. of original sectional area before fracture, and an elastic limit of not less than 25,000 lbs. per sq. in. of same sectional area, with an elongation before fracture of the test specimens of not less than 15 per cent., measured upon a tested length of 8 in. Also a reduction of area at the point of fracture of 20 to 25 per cent.

(2.) All iron for tension-members must bend cold for about 90° to a curve whose diameter is not over twice the thickness of the piece, without cracking. At least one sample in three must bend 180° to this curve without cracking. When nicked on one side, and bent by a blow from a sledge, the fracture must be nearly all fibrous, showing but few crystalline specks.

(3.) Specimens from "angle," "plate," and "shaped" iron must stand bending cold through 90°, and to a curve whose diameter is not over three times the thickness of the piece without cracking. When nicked or bent its fracture must be mostly fibrous.

(4.) All rivets and connecting-pins must be made of the best double-refined iron, having an ultimate tensile strength of 60,000 lbs. per sq. in., and be capable of being bent double when cold, so that the sides shall be in contact without showing any crack or breaking of iron fibre.

(5.) The cast iron must be of the best quality of soft grey iron, capable of sustaining a weight of 550 lbs. suspended at the center of a bar 1 in. sq. $4\frac{1}{2}$ ft. between supports. All manufacture must be full to dimensions, true, smooth, and sound.

(6.) All facilities for inspection of iron and workmanship shall be furnished by the contractor. He shall furnish, without charge, such specimens (prepared) of the several kinds of iron to be used as may be required to determine their character.

Near West Point, on the Hudson River, the longest double-track truss-bridge yet built has been erected to span a narrow bay of the Hudson. For several months during the early part of 1882 attempts were made to make a bank across this bay with materials from rock excavations on both sides. About 4,000 cu. yds. of rock had been deposited, when it became evident that on account of the steep slopes the material was going out into the river nearly as fast as it was deposited. To obviate this, a wooden crib was built to fit the slope of the rock, and loaded with about 2,000 tons of stones. The crib was about 200 ft. long, and 50 ft. wide in the center, with a depth in front of 40 ft., and on the inside, next the bank, of 10 ft. It was anchored to the rock by $1\frac{1}{2}$ in. anchor chains, fastened to $1\frac{1}{2}$ in. ring-bolts, extending 18 in. into the solid rock. There were in all five anchor-chains, about 150 ft. long. Without any warning this crib slid into the bed of the river, breaking the chains and lodging at the bottom, nearly 500 ft. out, in about 150 ft. depth of water. After this catastrophe it was decided to build a double-track iron bridge 290 ft. span from center to center of the end pins.

The use of steel for the bridge was contemplated, but the impossibility of getting prompt delivery of this material prevented its adoption. It was impossible to put up false-work that could be depended upon, and the erection was therefore somewhat of a problem. Two plans were considered: first, to erect the bridge on floats, but this was abandoned on account of there being a tide of $4\frac{1}{2}$ ft., and because the base of rail was only about 6 ft. above high tide. The second plan was to erect the bridge on one side of the permanent location, and then to slide it into place. This second method necessitated cutting into the solid rock of the mountain for a depth of about 40 ft. at each end, but was finally adopted as the only safe plan.

The bridge was erected 25 ft. to one side of the final site, and when completed, with the exception of the floor-system, was moved into its permanent place in six hours by means of hydraulic jacks. The total weight of iron in the finished span is about 519 tons. The bridge was designed and executed by the Central Bridge Works Company, of Buffalo, New York.

The railway crosses Rondout Creek at an elevation of 150 ft. above water in order to admit the passage of large schooners. The total length of the crossing is 1,244 ft., and it is covered by a trestle-work viaduct 531 ft. long, and three two-truss through-spans; one of 163 ft., one of 241 ft., and one of 264 ft. span. The spans in the viaduct are six of 50 ft. and one, next the large girders, of 60 ft., measured between facing columns. The girders in the viaduct are lattice girders 6 ft. deep. The shortest long span has trusses 32 ft. deep; the other two long spans have trusses 45 ft. deep. The weight of iron in the whole structure is about 2,000 tons, and the total cost of the bridge was about $350,000.

The erection was begun on the 8th of November, 1882, and the first train crossed on the 8th of May, 1883. The ironwork was designed and constructed by the Phœnix Bridge Co. in accordance with the specifications of the West Shore Railway, and the compression members in the large trusses and the pier columns are of the pattern known as the Phœnix column. The erection of this great structure involved much care and labor. No falsework was used in erecting the viaduct. Each pier consists practically of four iron columns resting on masonry, and firmly held in position by struts and ties. After the foundations had been completed the columns were raised in place by means of a "gin pole," resting first on the masonry, and afterwards secured by iron bands to the columns as they were built up. As soon as the first span was bridged a traveller on the top assisted in raising the rest of the iron.

Much more difficult was the work of erecting the three great spans. In their case it was necessary to build a trestle-work sufficient to bear the weight of the iron and resist the wind, which sometimes sweeps with great violence through the gorge.

In this structure all bolts were $\frac{7}{8}$ inch in diameter; all diagonal transverse braces were 3 inches by 8 inches; all horizontal transverse braces 4 inches by 8 inches, and all longitudinal braces 3 inches by 8 inches.

The trestle-work was supported upon piles: the height from the top of the piles to the caps was 142 ft. Four hundred and sixteen piles,

*From Other Selected Papers of the Institution of Civil Engineers.

and 300,000 ft. board measure of timber were used.

After the false work had been erected the trusses were easily put together. The total cost of erection was about 1½ cent per lb. This cost was from ½ to ¼ cent per lb. greater than it would have been in summer. The weather during the erection of the bridge was unusually inclement, and the ropes, staging etc., were covered with ice for much of the time.

A very interesting and novel lift-bridge is employed to carry the West Shore Railway over the Oswego Canal at Syracuse. It was necessary to keep the formation low in passing through the city, and an ordinary overhead bridge could not therefore be used. Railway swing-bridges are common in America, and are consequently fairly cheap and of reliable design; but the angle of crossing in this case is so acute, and the width necessary for a two-track bridge so great, that a swing-bridge would have been extremely cumbersome.

Lift-bridges are of two kinds; first, that in which the whole structure, except four corner columns, is moved up and down; and second, that in which the floor is hung from stationary girders placed above the necessary clearance, and the floor only is moved. Highway bridges of both kinds are common, but only the second kind had yet been used for railways. The new bridge, however, is of the first kind, and the complete girder, floor and track are lifted through 10½ ft. The weight of the bridge is about 146 tons, and there was much interest and a little anxiety concerning the probable movements of this great mass until the work was finished.

The bridge is provided with counter-weights suspended by wire ropes.

The general width of the Oswego Canal waterway through the city of Syracuse is 60 ft.; but at the point of crossing an encroachment of 20 ft. was allowed, making the clear square span, including the tow-path, 52 ft. The angle of crossing is 50° from a right angle, and the span on the skew 81 ft. 5½ inches.

The bridge abutments are walls of "first-class" masonry, 8 ft. thick and 14 ft. high, extending from a bed of shale about 3 ft. below the bottom of the canal to the level of the tow-path. Four piers of the same height and 4 ft. square are provided for the stays which brace the columns. The columns and stays are anchored by bolts 1½ inch in diameter built 8 ft. into the masonry.

The distance between the centres of the columns is 96 ft., and the bridge is a "two-truss through," 94 ft. long and 23 ft. high, with chords 16 inches wide spaced 29 ft. apart from centre to centre horizontally.

The rails are screw-spiked to oak sleepers 8 inches square in cross-section; these are spaced 16 inches apart from centre to centre, and are secured by fang-bolts to the flanges of the track-stringers. The track-stringers are rolled I beams, 12 inches deep, resting on angle-iron brackets riveted to the webs of plate cross-floor beams supported on the lower chords of the trusses at the panel points which are 9 ft. 3¾ inches apart.

The floor is stiffened laterally by 1¼ inch rods connected with the ends of the floor beams and adjusted by sleeve nuts.

The counter-weights are rectangular boiler-plate boxes 9 ft. long by 4 ft. square, closed at the bottom by a heavy casting and filled with pig-iron. Each counter-weight hangs from two steel wire ropes 1¼ inch in diameter furnished by the Roebling Co., New York. The ropes pass over cast-iron pulley-wheels of 7½ ft. effective diameter and 3 inches wide, with grooves 2 inches wide and 3 inches deep. The connections between the ropes and the 3-inch square bolt passing through the centre of each counter-weight, and the two bolts 2¼ inches in diameter, attached to each corner of the bridge, are simple and ingenious.

The ropes are threaded through wrought-iron conical thimbles, the ends of the rope enlarged by folding back the strands, the enlarged ends drawn back into the thimbles, and the vacant spaces "run in" with "Babbitt" metal well compacted by hammering.

The four counterweights weigh 140 tons and balance the bridge within about 6 tons. The small lifting power required is provided by a steam-engine with two 8-inch by 8-inch cylinders coupled at right angles, and placed with the boiler on top of the trusses.

Two lines of shafts 3 in. in diameter fixed on the top chords of the trusses turn four phosphor-bronze nuts fixed in collars to brackets on the end-posts of the trusses.

Through the nuts pass four double-threaded screws 3½ inches in diameter, with square cut threads of 2 in. pitch. The screws hang from the tops of the fixed columns and support the bridge when it is raised. One revolution of the engine gives the nuts half a turn, and lifts the bridge 1 in. The screws are freely suspended at their upper ends, and when the bridge is lowered it adjusts itself to its seat, and the screws raised from their bearings by a slight extra turning of the nuts are supported free from stress.

On two of the end posts of the bridge are guides connected with the columns. Each counterweight also has a grooved guide united to its columns. The bridge can be raised in thirty seconds, but the usual time is thirty-five to forty seconds. The steam-pressure used is about 60 lbs. per square inch.

Near the bridge just described the railway crosses an important street, and the city authorities required that the railway company should lower a bridge carrying the street over the adjacent canal so that a clear view of the railway crossing could be obtained. The old bridge, one of "bowstring" form with a cast-iron arch and wrought-iron tension members, has been taken down, and a bridge with a lifting floor has been erected in its place.

The angle of crossing is 56½° from a right angle, and the span on the skew 83 ft. The floor was first built of riveted beams 2 ft. deep, but after erection it was found necessary to stiffen it by adding two light trusses between the sidewalks and carriage-way. The latter is 25 ft. wide, and the sidewalks each 6 ft. wide.

The weight of the floor is about 60 tons, and it is fully balanced by semi-cylindrical troughs, filled with pig-iron and suspended by eighteen wire ropes of ¾ in. diameter, passing over the same number of cast-iron pulley-wheels, 2 ft. in diameter, placed on the upper chords of the overhead stationary trusses. These trusses are two double Warren girders 104 ft. long and 18 ft. high, placed 26 ft. apart on four columns 14 ft. high. The floor is attached to four vertical channel irons, to which four cast-iron racks 10 ft. long and 8 in. wide, with teeth of 3 in. pitch, are bolted. The racks gear with four wheels 3 ft. in diameter fixed on two shafts supported on the lower chords of the trusses. These shafts carry two toothed wheels 2 ft. in diameter, which are turned by two horizontal racks fixed in the same line to the through piston-rod of a cylinder of 3 ft. internal diameter and 6 ft. length of stroke. The lift of the bridge, 9 ft., is thus effected by a single stroke of the piston, which is moved by water from the city mains.

The cylinder is in no essential point different from an ordinary steam-cylinder, and the water is controlled by a common "D" slide-valve. The water company's engineer was afraid that the comparatively quick cut-off by this valve would cause bursting shocks in the supply-pipes; but the bridge has been successfully worked without any indication of shock. However, to allay all fears, a spring relief-valve opening at 50 lbs. pressure per square inch, and an air-chamber 6 ft. long and of 1 ft. internal diameter, have been fitted to the pipes.

The supply-pipe is 6 in. in diameter and seems too large, as the bridge is raised in thirty-five seconds with a screw-down gate-valve controlling the supply opened only 1½ inch.

The ordinary maximum pressure in the city mains at the canal level is 30 lbs. per square inch. The water is discharged from the cylinder into a sewer 33 ft. below, and the discharge pipe has been carefully arranged in the hope that it will keep full and balance, by the column of water contained, the atmospheric pressure on the exhaust side of the piston.

In conclusion the author would quote the following paragraph from a recent report upon the West Shore Railway by an engineer of great experience and high standing.

"This enterprise realizes the ideal road desired by railway managers. It has everything considered essential to the perfect road; nothing can be added. It has low grades, light curves, perfect track, and engines and cars of the most approved pattern. Everything is new; there is no old rolling-stock to be used up. Under these conditions (which heretofore have never existed on any road) the operating expenses will be remarkably low, lower than any road has ever attained. It will form the standard of comparison by which other roads are judged. Its annual reports will be read with great attention by railway managers and those interested in the transportation problem."

"The Wandle-Valley Main Drainage."*

BY WILLIAM SANTO CRIMP, ASSOC. M. INST. C.E. F.G.S.

The Wandle-Valley Main Drainage Works recently completed for the Croydon Rural Sanitary authority, embraces the construction of about 50 miles of main sewers, with the necessary outfall works, for the collection and disposal of the sewage of the parishes of Mitcham, Beddington, Merton, Morden, Wallington, and the special drainage district of Merton Rush, Surrey. The area of the combined district is 10,106 acres, and the present population about seventeen thousand. About one-fourth of the area is within the watershed of the Beverley brook, and the remainder in that of the River Wandle. The relative levels of the northernmost part of the district being lower in the Wandle watershed, and, in consequence of the more rapid fall of the valley, the flooding being less serious than in the valley of the Beverley brook, it follows that in a combined system of sewers, the most economical plan to adopt would be that in which the outfall-works were situated in the first-named valley, other considerations in reference to the disposal of the sewage being equally favorable; as, however, much difficulty was experienced in procuring land suitable for sewage disposal in the Wandle valley, in the early schemes prepared, one by Sir Joseph Bazalgette, C.B., President Inst. C.E., and one by Mr. Baldwin Latham, M. Inst. C.E., the outfall-works were situated in the Beverley brook valley.

As regards the physical character of the district, that part of it situated in the watershed of the Beverley brook is flat, and consists of London clay. The Wandle valley, on the other hand, has a comparatively steep fall, as attested by the numerous mills using the water power of the Wandle, and the geological features vary extremely. The watershed is a very large one, extending as far as Caterham on the south, Norwood on the east, and Sutton on the west; the chalk area alone exceeding 60 square miles. The Wandle derives its water from this large chalk area, and flows down the valley from its sources at Carshalton, Beddington, and Croydon, over beds of alluvium

* From Other Selected papers of the Institution of Civil Engineers.

lying on the London clay. Various animal remains were found in the cuttings for the sewer in this alluvium, among them the tusks and teeth of an elephant.

At the foot of the chalk hills near Wallington the outcrops of the Woolwich and Reading beds and the Thanet sands were cut through.

Previous to the construction of the works, about to be described, the sewage passed directly to the Wandle and the Beverley brook, the pollution of those streams increasing with the rapidly expanding population. So serious had this pollution become in 1878, that the owner of land through which the Wandle flows obtained a perpetual injunction, restraining the Croydon Rural Sanitary Authority from continuing to pollute the river. And it is a curious fact, that although the new sewage works are situated within 150 yards of the residence of the gentleman alluded to, the works have been so well conducted that cause for complaint on his part has not yet arisen. Previous to this occurrence, however, the authority had considered certain schemes for the diversion of the sewage. In 1873, in the scheme prepared by Sir Joseph Bazalgette, it was proposed to collect the sewage and dispose of it on land situated in the Beverley brook valley. In his report accompanying the plans, the various methods of sewage disposal were shortly referred to, and Sir Joseph pronounced himself as being in favor of irrigation his scheme being prepared in accordance with that conclusion. The "separate system" was to be adopted. The estimated cost was for 20 miles of main sewers, £27,500; outfall works and land, £26,000; or a total of £53,500. It may be remarked that in this scheme it was proposed to pump the whole of the sewage.

Subsequently, a proposal was made to extend the West Kent outfall sewer to Merton, at an estimated cost of £40,000. This sum was exclusive of the cost of the necessary internal works of sewerage and cost of pumping, the proposal therefore was not entertained.

In 1874, in the scheme prepared by Mr. Baldwin Latham, the Beverley brook valley was again selected as the site for the outfall works. In this project a length of 33 miles of sewers was proposed to be constructed, with the requisite outfall works. It was so far proceeded with, that a Local Government Inquiry was held, in order to borrow the money for the execution of the works. At the inquiry, however, the offer of the land for outfall purposes was withdrawn, the scheme was abandoned, and plans for the works recently completed were prepared by Mr. Baldwin Latham, approved by the sanitary authority, and sanctioned by the Local Government Board.

The necessary formalities having been gone through, the contract for the execution of the whole of the works was in 1878 let by public tender to Messrs. B. Cooke & Co., Battersea. The contract included the construction of 36 miles of main sewers, the outfall works, comprising pumping station, screening tanks, apparatus for consolidating the sludge, iron bridge over the Wandle, two cottages, and the preparation of a filtration area 28 acres in extent. In the interval between the commencement and the completion of the works, many new roads were constructed, so that important extensions were necessary, and the works as completed involved the construction of nearly 55 miles of sewers.

The part of the house-connections, from the main sewers to the boundary of the private property, was also let to the same contractors and executed by them within a period of six months from the completion of the main contract. The house-drainage works were constructed in accordance with the system recommended by the Local Government Board in the Model By-laws, and under the superintendence of the Surveyor of the Authority, Mr. R. M. Chart.

The scheme carried out is essentially one of separation as regards the sewage proper and the rainfall, the latter from the streets and roofs being, so far as practicable, diverted into the old sewers, drains and watercourses which were retained and improved for its reception. Although it is most desirable in rural districts to adopt the separate system on the score of economy as regards the sewers, and the greater ease with which the comparatively small volume of sewage is dealt with at the outfall in wet weather, it must be borne in mind that old sewers are for the most part imperfectly laid, and that they contain much deposit which cannot but have for a time a tendency to pollute the water passing through them, although, on the other hand, the pollution occurs in wet weather when there is much dilution.

Great care was taken in designing the system carried out, to bring as much of the sewage as possible to the land by direct gravitation. The sewers at the same time have the proper gradients to ensure a minimum velocity of 2½ feet per second where small, and of 2 feet per second where large. The sewers may be flushed from every dead end, and flushing-wells are constructed at various points where the subsoil contains sufficient water. The wells are near a manhole, and are each provided with a sluice-valve, on opening which the contents of the well are discharged into the sewer. The sewers are, with few exceptions, constructed in straight lines between each manhole or lamphole, and a manhole is constructed at each junction of branch with main sewers. The manholes are circular in plan, 5 feet in internal diameter at the bottom and 2 feet at the top, where a Latham's patent cover with spiral charcoal tray is fixed. The manholes are constructed with gault bricks curved to suit the varying diameters of the manholes. The outlet from each manhole is provided with a stoneware flushing block, having a projecting ground face and two iron lugs for the reception of the flushing-boards. The inlets are provided with a balance valve, in order to prevent sewer-air from travelling to the higher parts of the district. It is well known that where a branch sewer joins a main sewer which is at a much greater depth, the sewage, if allowed to drop down vertically, becomes greatly broken up, much foul air being in consequence liberated.

(TO BE CONTINUED.)

Determination of the Earth's Magnetism at Paris.

Very careful determinations of H, the value of the horizontal component of the terrestrial magnetic field, have recently been made at Paris by M. Mascart, the well known electrician. The measurements were made in the observatory of the Parc St. Maur, and the method of Gauss was adopted as one of those giving the most correct results. This consists in oscillating a magnetized bar under influence of the earth; then placing it a certain distance from another bar submitted to the action of the earth, and noting the deviation suffered by the latter. Let

M = magnetic moment of the bar.
K = its moment of inertia.
T = the duration of infinitely small oscillations.
R = the distance between the centers of the two bars.
a = the deviation of the auxiliary bar.
α = a constant determined by experiment.

If the deviating bar is perpendicular to the magnetic meridian, and directed toward the middle of the bar deviated, we have

$$H = \frac{\pi}{T}\sqrt{\frac{K}{R^2 \tan. a}}\sqrt{\frac{1}{R}\left(1+\frac{\alpha}{R^2}\right)}$$

If the deviating bar remains perpendicular to the direction of the bar deviated, tan. a should be replaced by sin. a. It results from the experiments that the mean value of the horizontal component at the observatory of the Parc St. Maur on July 1, 1884, is H = 0.19 414 ± 0.00012 C. G. S. unit. The error is probably below 0.0001.

Some Notes on Taking Topography with Special Reference to Railroad Surveys.

BY THEODORE LOW, C. E., PITTSBURGH, PA.

A topographical party should consist of at least three persons, and in some country the work can be greatly expedited by having the same composed of four men.

The party should be in charge of the chief topographer, and his assistants are termed assistant topographers.

The outfit should consist of a good hand level, a ten or fifteen feet light pine wood rod, or pole, graduated to feet and tenths; a smaller rod five feet long and graduated similarly, and a fifty feet metallic tape line. Another valuable instrument, which can be used to a great advantage, is a right angle optical prism, but which is, however, very rarely used, recourse being had to other methods hereinafter described, to obtain right angles.

The chief topographer should provide himself with a blank note book about five by eight (5″ × 8″) inches in size. The left hand page to be ruled in columns like this:

STATION.	LEFT CONTOURS	CENTER ELEVAT.	RIGHT CONTOURS.

and the right hand page ruled in squares of four to the inch.

All notes should be kept from the bottom to the top of the page, so that when the book is held in front of you the topography as delineated on the pages will appear as when looking before you on the ground.

In following the transit and level parties, the topographers will necessarily be some distance behind, generally one day, this for the reason that it is not possible for them to proceed with the taking of contours until they have been furnished with the level notes or ground elevations of the stations of the line surveyed. It is not absolutely necessary, though, for them to be a day behind, as they could be furnished with elevations at stated intervals, say every three hours or so, by the leveler, providing the latter kept up his notes in the field, which under all circumstances he ought to do.

As soon as furnished with a sufficient number of level notes or elevations, the topographers can proceed with their work, after first entering in the first column of the left hand page the numbers of the stations of the surveyed line and in the third the corresponding heights.

In regard to the distance apart vertically that the contours should be taken, I would advise five feet as the proper distance.

To proceed with the taking of the contours, let the topographer in charge, with the hand level to his eye, walk down the hill until his eye is on a level with the surface of the ground at the station. Then knowing the fractional distance vertically to go down to reach the first contour (it being at all times advisable to take contours the elevation of which terminate in even five or ten feet), one assistant, with rod in hand, goes down until the first contour is reached, the distance of this point from the stake is measured by the assistants with the tape line, and the distance and corresponding elevation marked down in the proper column of the note book. Having thus obtained the first contour, the others are taken at regular five feet intervals vertically, and for such a distance horizontally out as may be deemed necessary.

The mode of procedure may be as follows: let the chief topographer with his five foot rod and hand level, place himself at the point of the first contour and let his assistants proceed ahead in a direction at right angles to the sur-

veyed line, measuring as they go, the front tapeman, when he has gone a sufficient distance, holding up his ten or fifteen foot pole for the levelman to sight at, and at the same time moving ahead or back until signaled to stop when he is five feet lower vertically than the last point taken. The distance then of this contour is noted down, remembering to keep the continuous distance from the center line, this for the convenience of afterwards plotting the same. With a ten foot rod, it will be necessary for the levelman to move up to every point taken, but with a fifteen feet pole he can take two elevations before moving up.

In going up a hill the operation is a little different. Having the fractional distance vertically to go to reach the first contour ending in an even five or ten feet, hold up the rod at the stake and placing the hand level at the proper height, sight ahead at the ground where the line of sight cuts the same. Mark this place and measure the distance, noting the same in the proper column. Then let the levelman move ahead to this point and with the five feet rod for the level to rest on, sight ahead, again noting where the ground is cut and measuring this distance, put down the same as before. This operation can be continued as far from the line as may be thought necessary.

With the contour notes properly kept the left hand page of the book will then look as follows:

CONTOUR NOTES OF LINE. SURVEY.

STATION.	LEFT CONTOURS	CENTER ELEVAT.	RIGHT CONTOURS
3		859	
2	855 860 30 20	861	865 870 40 50
1	850 855 860 70 40 10	862	865 870 875 15 20 25
0	850 855 860 45 40 30	865	870 875 880 890 10 15 30 40

Although not absolutely necessary, I think it a good plan to take the contours at every station, that is, at every 100 feet, where very accurate work is required, otherwise it will only be necessary to take them at every change or variation of the ground, as well as in the lowest places where streams, etc., are crossed, and again at the angle where the steep slopes bordering the stream and the more level ground beyond intersect, or what is known more generally in engineering parlance, as the foot of slope and top of bank. Nor is it always necessary to take the contour at a right angle to the line, but the same can be taken on any course, providing the direction of this line is known.

For this reason the topographer should be provided with a small compass, which also serves the useful purpose of taking land and property lines, thus indicating with accuracy their true direction. In taking the contour, whenever any streams, roads, or any other topographical features of the country are crossed, the distance to, and a sketch of, the same should be noted down on the right hand pages of the note book. For this reason, pages ruled in squares are the best, as allowing the topographer to sketch in the topography very nearly to a scale.

Some engineers prefer to plot the contours in the field, directly upon the prepared sheets, that is on sheets on which the surveyed line has been accurately plotted according to the scale.

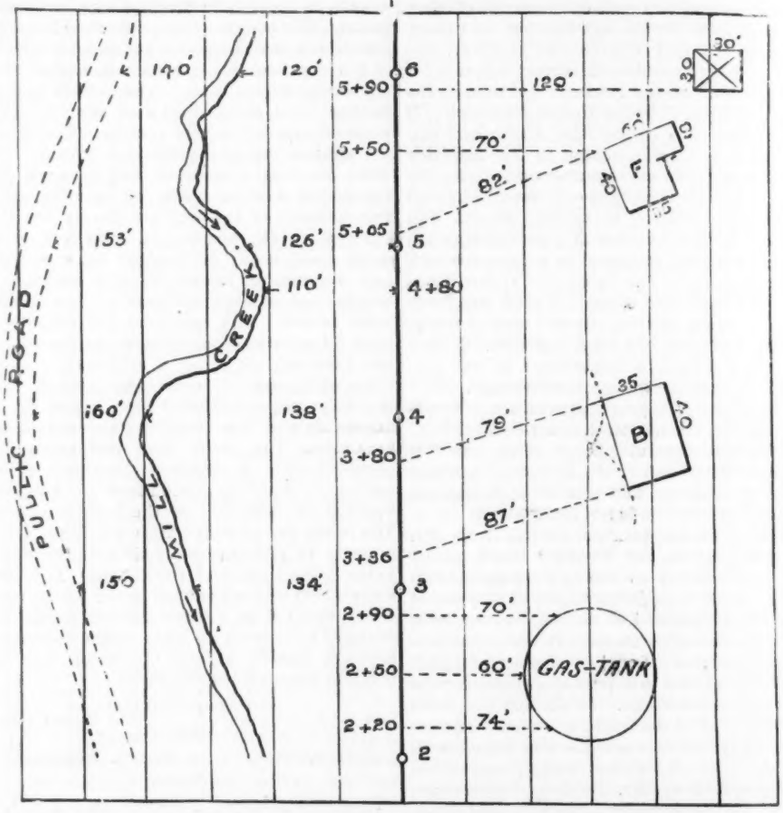
The topographer is provided with a light wooden portfolio made of two ¼ inch pieces of wood attached at the ends and bottom to pieces about ½ to 1 inch, making a kind of box in which the sheets not in use are carried.

The elevation of each station is noted opposite each one on the paper, and before starting out, the contours, where they cut the surveyed line, can be penciled in lightly.

Being also provided with a scale, (one 6 inches long is the most convenient) the topographer can jot down the contours as fast as taken on the ground, but a record of the same should also be kept in the note book, as in case a sheet should be lost or destroyed the same could thus be easily replaced from the notes.

One great advantage of plotting in the field is the fact of being able to sketch in the contour just as it appears in the ground, and which sometimes is impossible when the work is done in the office, and the contour taken the ordinary distance apart on the center line.

In the numbering of contours, always mark the full elevation of each contour, and at intervals, on a map of 200′ to 1″, of about 1800″, except where there is a large break in the ground, when at all such places the contours



should be numbered for the convenience afforded in afterwards making the paper location.

The contours should always be so numbered that they will read from the base to the summit of a hill.

In locating buildings, the right angle and plane method is most generally used. When a building is encountered on the survey, move along the surveyed line, until, by means of the right angle prism or cross, a point is reached where a right angle taken from the line will strike one corner of it, then if the building is parallel with the line surveyed, the side sighted at (if the building is square) will also be in a direct line with the point in the surveyed line. Then measure the distance to the same, also, at the same time getting the dimensions of the building and noting all in the proper place in the note book. Should the building not be parallel with the line, first get at right angles to one corner of it, as described above, measuring the distance to the same; then going ahead (or back) along the line, noting when the plane of the building cuts the same. Note this point according to the stationing of the line, and then properly recording the same in the note book.

Another good method of locating buildings, and perhaps the best in every case at least where the rough method of taking a right angle is used, is the following: Move along the center line until you reach a point where a line produced from one plane of the building intersects the center line. Note this point as before, and then move to another point where a line produced from the other parallel plane of the building also intersects the line. Note this point and then get the distances to the respective corners and also the dimensions of the building.

Now in plotting of the same describe arcs having for their radii the distances from the line to the corners of the building. Then by simply drawing a tangent to these arcs, you have the position of one of the planes, and by producing the radii from the tangent points the other two right angled sides will be given.

There seems to be a great deal of trouble experienced by some topographers in the locating of circular buildings, such as tanks for the storing of gas. About the most simple and consequently best method for the location of such buildings is as follows: From three different points in the center line, and at right angles to the line, get measurements to the building. This is all that is necessary, as the three points thus formed will determine the position of the building, the radius being found by the usual method of describing a circle through three points.

With notes properly taken the right hand page of the note book will look as the above.

Lines, for the purpose of getting the topography of rail road tracks, should be run about six or eight feet to the outside of the outer rail, where there are two or more tracks, so that there need be no interference from the running of trains. It is also best not to cross from one side of the track to the other too frequently, as what time is gained by the transit party in so doing, is more than lost by the topographers. Where the curves are not too many and of the reverse order, it is better to keep to the outside of the same, deflecting at each "set up" so much as to just "cut" the outer rail. This method benefits the topo-

grapher in as much as there is less liability of error in getting the true right angle as when the line crosses the tracks at a great skew.

In taking the topography of tracks, some topographers take measurements to the rail nearer the center line, but I think it is better to take measurements to the same rail that the first measurement was taken to, no matter on which side the center line may happen to be. This facilitates the plotting as in the case where the nearest rail was taken; every time the line crosses the track or tracks the topographer must necessarily stop and connect all back points and even then there is a possibility of getting the points of one rail connected with those of the other.

Georgia Capitol.

THE FOLLOWING ARE THE BIDS ON THE ENTIRE WORK:

D. W. Thomas, Akron, O.	$1,097 974 25
Miles & Horn, Toledo, O., according to the original specifications	922,124 47
With a slight change in the roof	957,096 00
With a change in the foundation	914,766 00
With a modification of the light shaft	910,121 00
To substitute cheaper material in various places	776,302 00
Hallowell Granite Co., Chicago, upon the original schedule	932,579 29
With modifications	888,277 93
With further changes	867,727 80
Charles Pierce & Co., Indianapolis, Ind.	922,860 07
Of oolitic limestone	929,356 22
Of Georgia marble	1,014,960 47
Of Georgia granite	1,141,784 07
A. E. Forten & Co., Chicago, building complete, except the cut stone work	777,816 00

THE PIECE BIDS.

The bids on work in detail were not as numerous as at the former bidding. That is explained by the fact that it has been generally believed that the work would be given out to one contractor, and to make bids on the parts of the work would be an unnecessary expenditure of time and labor. The following were the bids on the various parts of the building:

Ellithorpe Airbrake Company, for elevator	$ 3,685 09
Burnett & Co., Cincinnati, O., for the entire iron work	160,064 14
Same Company on the appendix an additional	7,600 00
F. Y. Gindele, Chicago, for the entire cut stone work	381,233 00
Knisely & Miller, Chicago, metal work, ventilators and sky light	51,758 00
Pioneer fire proof construction company, Chicago, fire proof tiling	30,622 00
Kelly & Jones Co., New York, boilers, pumps, fans, engines and steaming apparatus, including the work	28,365 00
M. E. Maher, Atlanta, excavation, concrete and footings in the foundation	60,880 00
B. H. Broomhead, Atlanta, all the brick masonry including cut stones for bond blocks and the appendix schedule	139,500 00
S. H. Venable, Atlanta, concrete	10,781 45
Footing stones	49,375 00
O. A. Smith, Atlanta, entire marble tiling and asphalt floor	7,986 00
Another bid with the specifications changed	6,750 00
Another bid with the specifications changed	7,450 00
Another bid with the specifications changed	6,250 00
W. F. Bowe, entire brick work according to original plan	127,000 00
For the appendix schedules an additional	8,850 00
Angus & Gindele, for the foundation work	117,873 38
A modified schedule	148,787 50
Gillis & Geoghegan, boilers fans, engines and steam heating apparatus	30,596 00
Deane Steam Pump Co., Massachusetts, for the three steam pumps specified in the schedule	1,917 00
C. W. Gray & Co., of Graysville, for the needed lime 90 cents per barrel or 75 cents per barrel in bulk	
Boardman & Wilcox, for the boilers, fans and steam heating apparatus	29,970 00
Georgia Marble Company, for the entire marble delivered in Atlanta in blocks not less than two feet cubes running to any desired size 80 cents per cubic foot delivered at the building	
Phoenix Iron Works, of Trenton, N. J. for all the iron work	191,377 75
Snead & Co., Louisville, Ky., for the iron work	197,503 00
J. A. Alexander, Atlanta, president of the Stone Mountain Granite Company. On schedule No. 1	154,133 00
With certain modifications	71,630 50
With still other modifications	73,916 04
Crane Bros., Chicago, elevator and appliances	3,000 00
S. J. Pope & Co., Chicago, entire drainage work	3,876 00
Boilers, pumps, engines and steam heating apparatus	28,375 00
Entire plumbing work	5,926 00
Entire gas fitting and electric lighting	4,500 00
If all are taken the bid for the whole is	41,93015
George & R. L. Barney, Swanton, Vt. for the tiling and asphalt floor	26,000 00
W. W. McAfee, Atlanta, concrete in the trenches	5,880 00
Wilkins, Post & Co., Atlanta, for the entire wrought and cast iron work and prismatic light	194,000 00
Same exclusive of the inside stairs	156,000 00

THE St. Louis cable and Western Railroad has been incorporated. Besides building a cable road in the city, the company propose to buy the St. Louis, Creve Cœur Lake & St. Charles Railway.

The Paris Schedule of Prices for Work.

A contractor's life is not a bed of roses in England; but his difficulties must be tenfold in Paris, where it seems there is a movement on foot in socialistic circles to suppress him altogether, and entrust any work that may be going to co-operative associations of workmen. The application of the schedule of prices for work executed in the City of Paris has always given rise to disputes between masters and men, the latter claiming a strict application of the official tariff as a minimum, while the latter regard it as contrary to freedom of trade and as prejudicial to their interests, M. Vaillant has brought before the Paris Municipal College a most remarkable proposition, of which the following is the substance:

In view of the necessity for immediate action, to prevent a complete stoppage of industrial operations, and in order to maintain the prices of the schedule until they can be revised each year in the interests of the workmen; seeing that the City ought to set the example which it should oblige its contractors to follow, seeing the necessity of these measures, until a law indispensable as long as the system of master and wages lasts, attenuates the homicidal effects of the masters' *laisser faire* and competition, by reducing the day's work and fixing a minimum of wages in accordance with the cost of production and living, the Council recommend as follows:

Art. 1. The schedule is to be rigorously applied in all works for the City of Paris, and any contract made between the City and a contractor to be null and void if a workman shall have been paid below the schedule prices, even by agreement between the contractor and the workman.

Art. 2. In case of contravention by the contractor of the provisions of Art. 1, besides the nullification of the contract, the percentage kept in hand on work done and the caution money shall be forfeited to the City authorities, who shall have the right of using all materials brought on the ground by the contractor for terminating the work.

Art. 3. In all works executed for the City of Paris, bargains and piece-work are forbidden.

Art. 4. The working day is fixed at eight hours, but the price to be paid is that fixed for the day of ten hours, the number of hours worked in the week not to exceed 48.

Art. 4. The City authorities shall make a minute inspection of all workshops and yards, and shall check the pay sheets, which should be settled regularly every fortnight.

Art. 6. No work shall be ordered, and no materials or manufactured articles shall be bought in a foreign country, if it can possibly be obtained in Paris, or at any rate in the Department of the Seine.

Art. 7. In all works for the City it is expedient to substitute for the system of public tender that of direct concession, without the intervention of master, to assisted workmen, who are enabled to execute the works through the credit of the City, and by the aid of its agents. This concession will be based on the prices of the schedule. Syndicates and workmen's societies will treat with the City for the workmen of the different branches who can co-operate in these works, and should do so by equal right.

A supplement to this proposition has also been deposited as follows:

Considering that workmen should enjoy the whole product of their labor until they be placed in possession of the whole social wealth, all the works of the City of Paris shall be exclusively confided to the *Chambres Syndicales* and the workmen's co-operative societies, the City supplying the plant and tools, and the *Chambres Syndicales* and Corporations the labor. The balance of wages above the schedule prices and the tariff fixed by the *Chambres Syndicales* shall be paid into the funds of the Corporation interested.

This is not only socialism, but also protection with a vengeance. The proposition has been referred for consideration to the fifth standing committee.—London Eng., *Contract Journal.*

The Canadian Pacific Railway.

"One hundred million dollars, worth of land and as much more in money subsidies is about what the Canadian Pacific Railway has cost Canada up to the present time," said a well-known ex-member of the Canadian Pacific Railway syndicate a day or two ago. "And this," he continued, "is only a drop in the bucket to what that great railway project will cost the country hereafter." The gentlemen who compose this syndicate it is generally conceded will not undertake to run the road after it has been completed. They will hand it bodily over to the Canadian Government, and that institution, which has acted so benevolently toward the Canadian Pacific Railway syndicate, will run the railway and make up deficiencies, which must necessarily be involved in the operation of such a road, out of the public treasury. That the portion of the road from Winnipeg to the Pacific coast must for many years to come be run at an immense loss of money, few, if any who are well informed on the matter will attempt to dispute. Much of the country through which the railway runs west from Winnipeg, as well as between Port Arthur (Thunder Bay) and Rat Portage, is totally unfit for any kind of agriculture. Therefore it must be admitted that the great bulk of the eastern traffic must come from the Pacific coast. The trade from the Orient to British Columbia is very small, and with the great competition of steamship lines to San Francisco and other American ports it must remain very limited for years to come, so that the railway may look for very little support in that direction.

The trade from British Columbia itself to eastern Canada and Europe is very light, being confined principally to the products of the salmon fisheries, which would not of itself keep an ordinary tramway running. Owing to the greater portion of the farming country in the northwest being situated between the American boundary line and the line of the Canadian Pacific, at a very considerable distance from the Canadian railway, the cereals it might otherwise carry to the east are out of its reach. It might construct a branch line into this farming territory, but it objects to carrying any portion of a railway too near the American boundary, fearing that if its main line is tapped by American western roads what little traffic it may command will be taken away from it by them. It was for this reason, it will be remembered, that the Manitoba Southwestern railway was disallowed by the government. The difficulty is keeping the road open in the severe winters experienced in the Canadian northwest, and especially that portion of the railway which runs along the north shore of Lake Superior, which is for hundreds of miles over a barren, exposed waste of land, which, along the coast of the lake shore the railway is intended to run, has during the past winters been rendered almost impassable by the accumulations of snow and ice. In the case of the American Pacific railways, the places where they found their terminis were, years before these railways were projected, the centers of thriving institutions and badly in want of railway connection with the east. In the case of the Canadian Pacific, it was very different. British Columbia did not even ask for railway connection with the east, and has no trade of any extent to offer it when this road reaches the Pacific coast. The fate of the Canadian Pacific is inevitable. If it is running to the Pacific coast from Winnipeg, it must be done at an enormous loss to Canada, for in such case, where the expense of construction has been so large, a railway, to pay running expenses at all, must have a well selected country to draw patronage from; therefore it is evident that if the Canadian Pacific Railway company attempts to open its line for through traffic directly it is completed in 1886 it will be "starved out" for want of patronage.—*Toronto Cor. St. Paul Pioneer Press.*

THE Secretary of War decided to waive the informalities in the bid of Benson & McNee, of San Francisco, upon the dredging to be done in the Virginia channel of the Potomac River, and has awarded them the contract in accordance with the recommendation of Major Hains, Corps of Engineers, who is in charge of the work.

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THE Barber Asphalt Company had a paving contract amounting to $210,000 with the City of New Orleans. Thirty-eight thousand yards have been completed, upon which the city owes $36,000 of the $126,000 called for by the contract. Legal complications have arisen and both payment and work have stopped.

A BILL to recover $650,000 from the Alabama Improvement Company has been filed by the Tennessee Coal and Iron Company, on the claim that certain provisions of a contract covering this amount have not been fulfilled.

A PROJECT is under discussion at Berlin and Vienna to connect the Baltic and Black seas by a canal from the Danube near Vienna through Moravia, Austrian and Prussian Silesia to a point on the Oder near Breslau. Distance in a straight line, 200 miles, cost, $100,000 per mile of completed canal.

THE *Ferro Carril del Norte* is the name of a line of railway which is being built from Guatemala eastward to Puerto Barrios on the shores of Honduras Bay. Messrs. Lyman & Gordon have the contract for 155 miles of it from the first named terminus to El Mico, and Shea, Cormick & Co. of Knoxville, Tenn., will construct the first 62 miles of track from Puerto Barrios to El Mico. Several miles of the work have been completed.

THE Pennsylvania Railroad Company has sent this notice to the Baltimore and Ohio road:

The Board of Directors of the Pennsylvania Railroad Company do not consider that it is to the interest of this company to continue to run special service, or to haul the express, baggage, or passengers of the Baltimore and Ohio Railroad Company over its lines, and this company will cease to haul such cars over its lines on Oct. 12, 1884, but it will receive passengers, baggage and express matter of the Baltimore and Ohio Railroad Company at the regular stations provided by this company in Baltimore.

The order of the Pennsylvania Railroad applies for the present only to passenger business. The through freight will not be interfered with.

THE late terrible outbreak of cholera in Naples has finally and forcibly called public attention to the necessity for better sanitary regulations in that city. It is a step demanded by the general safety of Italy, and as Naples alone is unable to meet the expenditure required, it is recommended that the general government take the matter in hand. The desired improvement can only be brought about by pulling down a great part of the four worst quarters in the city and opening broad streets and squares. In these sections the population is crowded into closer quarters than in the worst parts of Paris, London, Vienna or Berlin; in some places 70,000 people live in a space of 3,200 ft. square, many of them in damp, underground rooms.

THE latest thing in railroads is a Southern variety known as a pole road. No grading is necessary; cedar poles are laid on the ground and fastened by pegs driven into the earth. The wheels of the rolling stock are provided with a double flange, and have several inches play on the axle. There are three locomotives in existence, designed to run on these roads. The "Escambia," built by Adams & Price of Nashville Tenn., is rated at 150 horse power when making six miles an hour, and is able to to pull twenty cars with 2,000 feet of lumber to the car load. The "Escambia" will be employed at the saw mill of C. L. Lowell & Co., Wallace Station, Ala. There is a growing demand for pole roads in the lumber regions of the South.

THE North Hudson County Railroad Company have nearly completed the superstructure of the elevated cable road, which they are building from the Hoboken ferries to Jersey City Heights. The structure is at present a little over a mile in length, and at one point is about 100 feet from the ground. The ironwork is somewhat lighter than that of the New York Elevated roads, as the rolling stock will be lighter, there being no locomotives. Work was commenced last October, and will be finished early next year. The foundations are all on piles. The supports are of channel beams connected by lattice work. The transverse and longitudinal trusses are of built beams with angle irons for bracing, and upon the lower chords of the latter rest the cross beams which carry the stringers upon which the track is laid. The supports where the line crosses the swamp are connected together in sets of four by horizontal and diagonal bracing. Mr. John J. Enrees is the engineer in charge.

FOR sometime past K. P. Corbyn and W. H. Hean, contractors, have been engaged in the construction of a new crib for the Hyde Park Water-works, near Chicago. A platform, 40 ft. square, supported on piles was used for the temporary work at the lake end of the tunnel; a shanty was built upon this staging and in it the laborers have been living for some weeks.

On October 8th, fourteen men in all, including the two contractors, were upon the work; a storm raged during the night and the waves finally washed away the hut and then began to sweep over the platform. Messrs. Corbyn and Hean were among the first men carried off by the sea, and before assistance could reach them from the shore, all but four men had been lost. They were exposed to the full fury of the storm from 7 to 11 A.M., when those left were rescued by the crew of the Chicago Life Saving Station.

Engineering Prospects in China.

One of the results to be expected from the present struggle between China and France is a little more attention paid to the future building of railroads in the Flowery Kingdom. The most conservative government official must now recognize the crying need of rapid land communication between the seaport towns, and that in thwarting the projects of the Viceroy Li Hung Chang, who for a Chinaman is progressive, they have wasted the years of peace now past, and are without adequate means of handling troops or war material.

According to late and sufficient authority there is no popular fear of railroads, as generally reported; the seven miles of track now serving as an outlet to the Kaihing coal mines, with its three locomotives and home-made rolling stock, is looked upon with great favor and admiration by the general public in its vicinity and its extension is much desired. The real opposition comes from the narrow minded official class, prejudiced against all innovation from the "outside barbarian." The lesson they are now learning may teach them that there are some good things out of China, and with a breach once made in this Chinese wall of conservatism, a brighter future may dawn upon the Empire, as far as modern progress is concerned.

Even now a project is on foot, backed by Chinese and American capital, looking towards the developement of the mining resources of China. The scheme is under the direction of a distinguished Chinaman, who is also an American citizen, and the engineers are to be mainly American. The present conflict of course will delay the vigorous prosecution of this project, but the return of peace will again bring it actively forward.

PERSONAL.

MR. A. A. ROBINSON, General Manager of the Atchison, Topeka & Sante Fe, was married recently to Mrs. Ellen Frances Williams, of Topeka, Kansas.

COL. WALTER MCFARLAND, Corps of Engineers, United States Army, stationed at New-Haven, Conn., has been ordered to relieve Capt. James Mercur of the work of river and harbor improvements at New York City.

WILLIAM B. PARSONS, Jr., late Roadmaster of the Greenwood Lake Division of the New York, Lake Erie and Western Railroad, has been promoted to the position of Roadmaster of the Susquehanna division of the main line of the same road. The division over which MR. PARSONS now has supervision is an important one, extending from Susquehanna to Hornellsville, a distance of 140 miles. He takes charge at once with headquarters at Elmira.

PHILIP QUIGLY, an extensive bridge builder and contractor, died at his home in Wilmington, last Saturday, after a short illness of typhoid fever. He was in his 68th year, and leaves an estate valued at nearly a quarter of a million. He built some of the largest bridges in this country, and was also contractor for the erection of Horticultural and Machinery Halls for the Centennial Exposition in 1876 at Fairmount Park.

SUPERINTENDENT CONWAY, of the Lachine Canal, has just completed his thirtieth year with the St. Lawrence Canal system as an officer of the Canadian Government. His connection with the canals dates much furthur back, he having been employed on the work as a boy when the canals were being first enlarged in 1844-5-6. The Montreal *Gazette* says: "All the officers who were employed in the engineers' and collectors' offices in Sept., 1854, have since died, and there are only five of those employed at that time in any capacity on the canals who are still employed in connection with them. During these thirty years of service MR. CONWAY never once applied for leave of absence, and, what is still more remarkable, has never been a day absent from duty on account of sickness.

DR. J. W. DAWSON, L. L. D, F. R. S., F. G. S. C. M. G., principal of Mc Gill College, Montreal, upon whom the honor of Knighthood has recently been conferred is a native of Nova Scotia, having been born there in 1820. He studied in Edinburgh, and on his return devoted himself to the study of the natural history of Nova Scotia and New Brunswick, assisting Sir Charles Lyell in his researches. He was for five years superintendent of education for Nova Scotia, which he left in 1855 to become Principal of McGill College, He has published a number of scientific works of great interest and value, among which Archaia, the Story of the Earth and Man, and The Dawn of Life may be mentioned, He discovered the fossil known as Eozoon Canadensis of the Laurentian limestone. which is the oldest known form of life. In 1881 he was, for his signal services, made a C. M. G., and the following year was named by the Marquis of Lorne first president of the Royal Society of Canada.

LITERATURE.

N. W. Ayer & Son's American Newspaper Annual. Containing a Catalogue of American Newspapers. A carefully prepared list of all newspapers and periodicals published in the United States, Territories and Dominion of Canada, with valuable information regarding their circulation, issue, date of establishment, political or other destinctive features, and advertising rates, together with the population of the cities and towns, as well as of the counties in which they are published, etc. Philadelphia, 1884. N. W. AYER & SON'S, Publishers, Price $8.00.

After the above very comprehensive title little remains for description; we can only add that for many purposes this publication is an invaluable office book. The publications listed are carefully classified by their distinctive features and also arranged by counties, showing at a glance all the newspapers, etc., published in that county. The miscellaneous lists and tables are also most useful, exhibiting location, county-seat and population of each county; population of every State, etc., and all large cities and towns; and lists of towns having a population over 5,000. For purposes of reference, comparison and advertising the work should meet every want. The annual contains the names of 603 periodicals of all kinds published in the city of New York, and 224 published in Philadelphia.

(FROM THE INSTITUTION OF CIVIL ENGINEERS.) *Emery Wheels and Emery Wheel Machinery.* By W. O. ROOPER. Stud. Inst. C. E.

The Comparative Value of Labor in Different Countries. By C. O. BURGE. M. Inst. C. E.

The Elevation, Storage, and Shipment of Grain. By W. PILKINGTON. M. Inst. C. E.

The Basic, Open Hearth Steel Process. By THOS. GILLOTT. M. Inst. C. E.

Experiments on the Transmission of Heat. By G. A. HAGEMANN, of Copenhagen.

Wire Gun Construction. By J. A. LONGRIDG.

Hydraulic Propulsion. By S. W. BARNABY, Assoc. M. Inst. C. E.

(FROM THE INTERNATIONAL INSTITUTE.) *The International Standard* for September, 1884. Published Bi-Monthly at 64 Euclid Ave., Cleveland, O., $2,00 per year. Everybody who is interested in Pyramid Literature should have it.

The Steam Engine Indicator and its use. A Guide to Practical Working Engineers for Greater Economy and the Better Working of Steam Engines. The Indicator and what its object is; its Construction and action thoroughly explained; together with the Method of Calculating the Horse-power of Engines as shown by the diagrams. By WILLIAM BARNET LE VAN. Illustrated with twenty engravings. Van Nostrand's Science Series. No. 78. Price 50 cents.

The above is reprinted from the *Mechanical Engineer*, but has been rewritten, revised and elaborated by the addition of further matter. It is intended to be elementary and well carries out the promises set forth in its title. It is not only a useful but an interesting and valuable text-books to all concerned in steam engineering, in relation to the determination of of power.

The Bismarck Bridge. A report to A. Anderson, Engineer in Chief of the Northern Pacific Railroad. By GEORGE S. MORISON, Engineer and Superintendent of the Bismarck Bridge. New York, 1884. Price $5.00

The above work is a large oblong folio of 22x14 in. with 43 pages of text and tabular matter and 26 plates. It is very thorough in its treatment of a difficult and important structure and is correspondingly valuable to the engineering fraternity. Reports as complete as this one are entirely too rare in our country, the great cost of production being generally a bar to their publication.

In the present report, Mr. Morison commences with the purpose of the bridge at this point and a statement of the peculiar conditions encountered on the upper Missouri River. This is followed by a general description and the detail of the river rectification works, the substructure, superstructure, approaches and finally the cost.

In the shape of an appendix are given a list of the engineers, employees and contractors; specifications for substructure and superstructure; borings and tests pits, pile driving, cement account, description and strength of floor system, strains in the 400 feet span, steel tests, report of testing committe, etc.

The plates are large, plain and detailed, showing all the various points of engineering and constructive interest connected with the works. They include all the general plans in elevation and profile, river bars and channel, caissons, air-locks, masonry, machinery barge and derrick boat, and elevations, plans and detail of the 113 feet and the 400 feet spans. Dimensions, sections and all detail are carefully and fully illustrated both in plates and in text.

The text, being virtually the official report of the designer of the bridge and the engineer in charge of construction, is of especial value and interest; no vital point remains untouched, and all parts are fully and clearly explained.

In the tabulated statement of cost of the structure, Mr. Morison has very wisely separated "freight charges" from the other items of expenditure. From this table we perceive that while the total cost of the bridge, including protection works, engineering and all other than freight charges was $855,860.01, the charges for transportation of material alone to the bridge site was $223,109.91, about 20 per cent. of the total cost of the structure.

The report on tests and analyses of the steel used is worthy of especial attention from engineers, from its completeness and the authoritative source from which it comes.

Transactions and Proceedings of the American Society of Civil Engineers. July, 1884.

CONTENTS:—"*The proper compensation of Railroad Curves*" by WILLIAM R. MORLEY *and a discussion of the subject* by A. A. ROBINSON, LEWIS KINGMAN, A. M. WELLINGTON, WILLIAM H. SEARLES and CHAS. E. EMERY. "*The Heavy Gun Question*" by CAPT. O. E. MICHAELIS, U. S. A.

The paper of Mr. Morley and a brief abstract of the discussion has already been given in this journal, about the time of its reading on April 18, 1883.

The paper of Capt. Michaelis was read at the Buffalo Convention of 1884, and is a vigorous attempt to awaken public interest in the better armament of our fortifications. After pointing out the utterly defenceless condition of our shores against modern artillery, and the fact that America not so long ago led the world in armament, with Rodman, Dahlgren and Parrott ordnance, Colt's revolvers, Gatling guns, breech-loading rifles and Ericsson monitors, and that the inventions of Americans are being appropriated by foreign nations and utilized in arming their forces by land and sea, the author suggests the regaining of this ascendency.

Capt. Michaelis reviews the action of the U. S. Foundry Board and, contrary to their opinion, believes that government cannon can be made by private parties without detriment to governmental interests. He cites the experience of foreign nations and our own experience during the civil war. A standing annual appropriation by Congress of $2,000,000 per year and an application of intelligent work and brains to the casting of guns from open hearth steel will, the author believes, solve the problem of arming our forts in accordance with the demands of modern warfare. A sketch of a proposed open hearth steel gun of 12 in. calibre is submitted with the paper, along with the opinions of accepted steel and iron experts upon the feasability of casting such ordnance and making use of the plant now in private hands.

Transactions and Proceedings of the American Society of Civil Engineers. August, 1884.

CONTENTS:—*Landing Arrangements, etc., for a Car Ferry on the Mississippi River*, by ROBERT MOORE. *The Strength and Elasticity of Structural Steel and its Efficiency in the form of Beams and Struts*, by JAMES CHRISTIE.

Both of the above papers were read at the Buffalo Convention. That of Mr. Moore is a detailed, illustrated desciption of the arrangement for transferring cars across the Mississippi River, for the Belleville & Carondelet R. R. Co. at St. Louis. The vertical range of the river at this point is 41 1/10 ft. and after describing the difficulties of the construction and maintenance of the inclines, a very brief description is given of the "cradle" or moving table by which the cars are transfered from the boat to the incline. The accompanying illustration is however so clear as to make extended description unnecessary.

The paper of Mr. Christie is chiefly valuable as a record of tests of the tensile resistance and ductility, etc., of steel, with varying proportions of carbon, used as beams or struts. Mr. Christie states that the tendency will be for struts of steel and iron to approximate towards equality of resistance as the lengths are increased. The mild steel will be the first to fall to equality with iron, and experiments show that practical equality between the strut resistances of these two metals will be reached when the ratio of length to least radius of gyration is about 200 to 1. At this point hard steel has still an advantage in strength over the other materials of about 22 per cent.

TRACK.*

BY W. B. PARSONS, JR., C. E.
ROADMASTER SUSQUEHANNA DIVISION ERIE R. R.

(*Continued from Page 164.*)

The simplest form of the Rail-bender is shown in Fig. 1. The two arms are hooked either over the head of the rail or under the base, according to the style of machine and

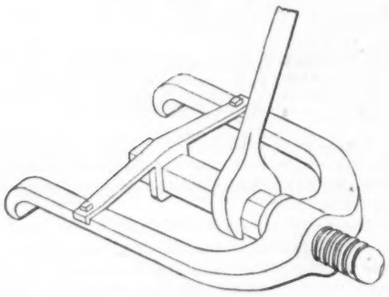

FIG. 1.—RAIL BENDER.

pressure applied through the screw. Patented devices in great variety also exist, deriving their power from eccentrics, hydraulic motors and other mechanical appliances.

Track Levers, Fig. 2, are used when track is being raised considerably, several men being able to bear down on them at one time. A ring is provided at one end to facilitate carrying. They are best made of oak, and in length

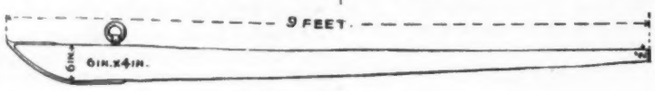

FIG. 2.—RAISING LEVER.

about 9 to 10 ft. They are shod with $\frac{3}{16}$ in. iron turned up as shown in the figure.

Convenient sizes and weights to make the regular tools are here given; to which is added in each case the necessary labor required in their manufacture, by stating how many a blacksmith and helper can make in an average day's work of ten hours, that is, the daily capacity of each fire. The exact cost in dollars of each tool can thus be readily found when the value of the raw material and the rate paid for labor is known.

This question of cost of labor varies according to several conditions, such as rapidity of the workmen, facilities at hand for doing work

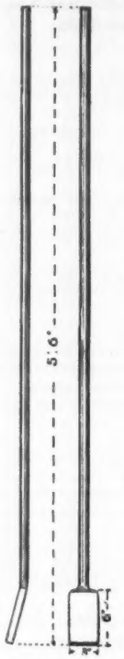

FIG. 7.—TAMPING BAR. Weight 13 lbs.

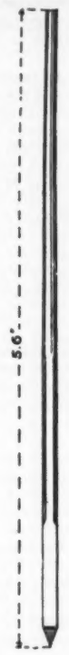

FIG. 8.—LINING BAR. Weight 30 lbs.

convenience of shop arrangements and whether the tools are made of new material or from the assortment of old junk, which is always collecting around a railroad blacksmith's shop, such as bridge rods, broken points from cast frogs, old tools, etc., material which in every case can be utilized and although it may take more labor to remodel the old, yet a general saving on the whole is effected. Figures, however, as given here, are taken from actual work and can be relied on as a safe guide.

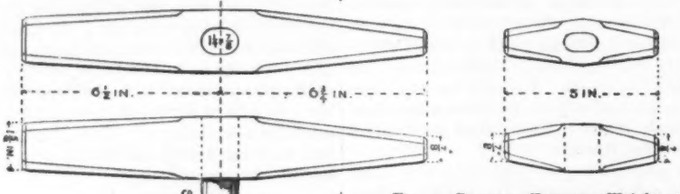

FIG. 4.—BALLAST HAMMER—Weight 3½ lbs.

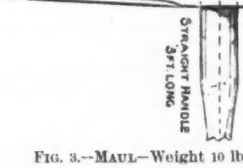

FIG. 3.—MAUL—Weight 10 lbs.

Spike Mauls, (Fig. 3) made of $2\frac{1}{2}$ in. square iron with piece of cast steel welded on each end. Face, octagonal $1\frac{3}{4}$ in. across and $6\frac{1}{2}$ in. square at center tapering off to $\frac{3}{4}$ in. octagonal face at each end. Length when finished 5 in.; and weight about 3 lbs. Oval hole $1\frac{1}{4} \times \frac{3}{4}$ in., about fifteen can be made in one day.

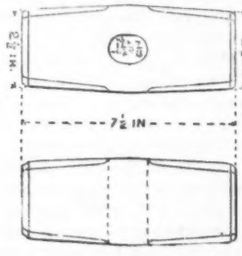

FIG. 5.—SLEDGE—Weight 12 to 13 lbs.

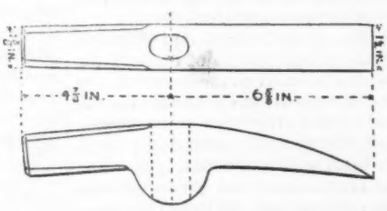

FIG. 6.—TRAK WALKER'S HAMMER—Weight 4 lbs.

Sledges, (Fig. 5) $7\frac{1}{2}$ in. long with $2\frac{1}{2}$ in. octagonal face on each end. Oval hole $1\frac{1}{4} \times \frac{7}{8}$ in. punched in center. Weight about 12 or 13 lbs. From four to eight can be made in one day according as old or new material is used.

Track-walker's Hammer, (Fig. 6) made of $1\frac{3}{4}$ in. square iron drawn out to octagonal face at one end and to an adze edge $1\frac{1}{2}$ in. wide at the other, making total length $11\frac{1}{2}$ in. Both face and bit are of steel, eye oval $1\frac{1}{4} \times \frac{7}{8}$ in., center being $4\frac{7}{16}$ in. from face. Weight 4 lbs.; about ten can be made in one day.

Tamping Bars,—(Fig. 7). The end is made of iron $6 \times 3 \times \frac{3}{4}$ in. welded into a handle of $\frac{7}{8}$ in. round iron, giving a length over all of 5 ft. 6 in. with weight about 13 lbs. The end is welded on at such an angle as will be convenient for a man to strike well under a tie. Twenty can be made in a day. They should be sent to shop for redressing before getting much rounded.

Lining Bars,—(Fig. 8). Lower end made of 2 ft. 6 in. of $1\frac{1}{2}$ in. square iron to which is welded 18 in. of $1\frac{1}{8}$ in. round and to this is added 18 in. of $1\frac{1}{4}$ in. round all nicely tapered together. For the point weld in a piece of steel, when finished to be 5 ft. 6 in. long and weigh about 30 lbs. Make about eight in one day. The point should be "diamond point" or sharp. This bar is an extremely useful tool whose place cannot be filled by any other. With its sharp point it can be driven down firmly into the ballast, and thus obtain a good foot hold as a fulcrum to throw the track when lining is to be done. Two men can take hold of one bar.

A bar with a straight "chisel" or flat point is of little or no use.

TO BE CONTINUED.

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The Navarro Meter.

ALBANY, Oct. 7.—The decision of the Court of Appeals to-day in the case of John Baird against the Mayor, etc., of the city of New York, involves a judgement against the city of about $1,500,000. It is the famous water meter case, which has come down as a reminiscence of the days of Boss Tweed. In 1871 when Commissioner of Public Works, Tweed awarded a contract to José F. De Navarro for 10,000 water meters at $70 each. A competitive examination was held, and from the 40 entries Mr. Edward H. Tracy selected the Navarro meter and recommended its adoption to Mr. Tweed. It appears that the meters were furnished to the city, according to the contract, but for some reason they were never used, and the municipal authorities refused payment. After the disclosures of the rascalities of the Tweed Ring there was a suspicion that this contract might have been one of the ring's jobs, and the claims of Mr. Navarro were stoutly resisted. His suit against the city was referred to Judge John K. Porter, who had the matter before him seven years' both sides being represented by very able counsel. Judge Porter finally rendered a judgment in favor of Mr. Navarro for about $1,125,000. An appeal being taken to the General Term by the city on the opinion of Judge Daniels, the decision of the Referee was set aside, both on the facts and the law. Mr. Navarro, or rather his Assignee, John Baird, carried the suit to the Court of Appeals. The case was argued last June at Saratoga, Judge Samuel Hand, of Albany, and Judge Ashbel Green, of New York, appearing for Mr. Baird, and Francis N. Bangs for the city. The court to-day handed down a decision reversing the judgment of the General Term and affirming the judgment entered on the report of the Referee. The opinion, written by Chief Judge Ruger, is concurred in by all the Judges. It is thought that, with costs, and interest, the city will have to pay nearly $1,500,000.

CORRESPONDENCE.

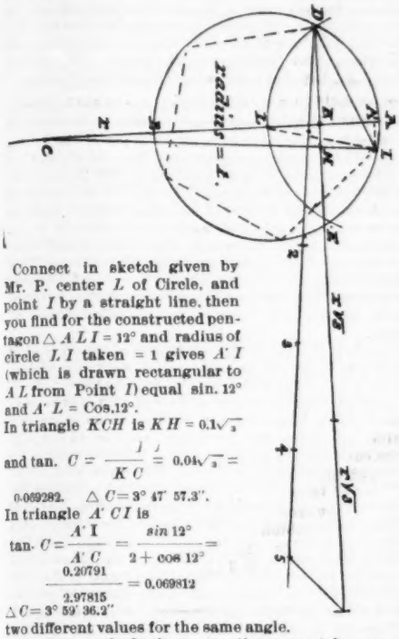
Constructing a Polygon.

Special Correspondence Engineering News.

UNION PACIFIC R. R. CO., ENGINEERS OFFICE.

HUNTINGTON, OREGON, SEPTEMBER 1 1884

EDITOR ENGINEERING NEWS.—Mr. E. A. D. Parker gives in your paper of August 23d, a method of constructing a polygon of any number of equal sides, which is not correct.



Connect in sketch given by Mr. P. center L of Circle, and point I by a straight line, then you find for the constructed pentagon $\triangle A\,L\,I = 12°$ and radius of circle $L\,I$ taken = 1 gives $A'\,I$ (which is drawn rectangular to $A\,L$ from Point I) equal sin. 12° and $A'\,L$ = Cos. 12°.

In triangle KCH is $KH = 0.1\sqrt{3}$

and tan. $C = \dfrac{I\ J}{K\,C} = 0.04\sqrt{3} =$

0.069282. $\triangle C = 3°\ 57'\ 57.3''$.

In triangle $A'\,C\,I$ is

$$\tan.\ C = \frac{A'\,I}{A'\,C} = \frac{sin\ 12°}{2 + \cos 12°} =$$

$$\frac{0.20791}{2.97815} = 0.069812$$

$\triangle C = 3°\ 59'\ 36.2''$

two different values for the same angle.

Mr. P.'s method of construction cannot be recommended for exactness; the incorrectness can also easily be found by the proportion

$$\frac{A'\,I}{A'\,C} = \frac{K\,H}{K\,C}$$

$$\text{or } A'\,I = \frac{K\,H}{K\,C}\,A'\,C = sin\ 12°$$

$$= \frac{0.1\sqrt{3}}{2.5}\,2.97815$$

$$= 0.20632328$$

while sin 12° gives 0.207912

Respectfully,

H. HAGN.

[When Mr. Parker submitted the above method to us, we could see no geometrical proof of its correctness but seeing that it was correct for the limiting cases—i.e., in the case of a three sided polygon, and in that of an infinite number of sides—and also for the intermediate case, the hexagon, we assumed that it was practically correct for all cases and published it. The above demonstration by Mr. Hagn shows that it is not the "accurate method" claimed, but an investigation of the amount of error shows that it never exceeds 16' which would not be appreciable in any construction on an ordinary drawing board.

Number of sides	Arc Subtended	Arc given by construction
3	120°	120°
4	90°	89° 47' 1"
5	72°	71° 54' 33"
6	60°	60°
10	36°	36° 10' 40"
12	30°	30° 12' 59"
15	24°	24° 14' 37"
18	20°	20° 15' 2"
24	15°	15° 14' 34"

By making the distance $B\,C = .4844$ Diameter instead of $= r = .5$, Diameter the error would be almost entirely removed. Few cases would, however, arise in practice where this refinement of accuracy would be required.

ED. ENG. NEWS.]

Irrigation in Montana.

Special Correspondence Engineering News.

BILLINGS, MONTANA, Sept. 27, 1884.

EDITOR ENGINEERING NEWS:—Montanans who have endured the aerial blasts of hail and snow for more than one season, are very jealous of the reputation of our territory; and when misrepresented, a retort, based upon facts, is certainly excusable. Thus it is in the article on *Irrigation in Montana* in your issue of September 20th. The author must be what *we* term a "tenderfoot," and has posted himself very little upon the subject of his article, otherwise in passing over the line of the N. P. R. R., which he refers to with so much satisfaction, he must have noticed in the Valley of the Yellowstone—also in Montana, near Billings—a ditch—*Canal*—running by and crossing the line of the railroad. This ditch is thirty-eight miles long, thirty-five feet wide and four feet deep. To use a *more* correct engineering expression, the top is defined in width by a slope of one to one. This ditch was finished last year and has been in successful operation during the past season.

We could herald the names of the men connected with this, to us, not so wonderful an enterprise, but will rest content in saying McIntyre did not do it. This valley also has a ditch ten miles long which has been two seasons in operation; another, eighteen miles long with viaducts and head gate arranged for a twenty foot bottom, is now in process of construction by the economical method of co-operation. In this same valley, near Miles city, a ditch was planned and staked, twenty-eight miles in length, fourteen miles of which was built last season. Now, we move that you withdraw your clause about "McIntyre originating," etc. He follows far in the wake—not a leader—and "the interest which he first awakened in enterprises of this kind," was in his *own* heart excited by the certain prospect of great gain from the sale of water and land. That irrigation is a success is true, as was demonstrated many years ago.

If his article is authority (?) Eastern Montana, and not Ann River, leads in irrigation. The next time Mr. Marshall appears he would do well, not only to use more diligence in procuring information on his subject, but also employ a consulting engineer to correct his technical expression.

J. C. ISAACI.

Supt. Common Creek Co-operation Ditch Co.

Engineering in South America.

Special Correspondence Engineering News.

ARGENTINE REPUBLIC, S. A., BUENOS AIRES, Sept. 1, 1884.

EDITOR ENGINEERING NEWS:—I see in your journal occasional inquiry from Civil Engineers and others as to the probability of obtaining professional employment in this country—and have received some letters making similar inquiries.

The public works in this country are built by the National and Provincial governments—or by English companies with a government concession and guarantee. There is a department of National Engineers here in charge of the engineering of all government work and from which all the engineers are supplied. Some European engineers are employed, but only when enough of the native born—making pretensions to the profession—cannot be found to fill the places. The same can be said of the mechanical and operating departments of the railroads. The Western railroad of this province being built and owned by the Provincial Government, is known as a huge political machine, in which fealty to the political administration in power, is the *first* requisite for obtaining employment, and in many instances the *only* qualification. Any one familiar with political administration of commercial enterprises can guess as to the economic results of such a system.*

The English companies get their money of course from England, and employ English material, machinery and labor. The subscribers to the stock of such companies being to a great extent manufacturers of material and machinery, or having "sisters, cousins and aunts" interested, naturally demand consideration for their products, or employment for their friends, and in this they are quite right, although "the average Englishman lacks the tact, adaptability to new surroundings and ability to make himself *generally* useful that is credited to his first cousin on the west side of the North Atlantic." (I am now quoting English authority in substance, if not in words.)

There are a number of railroad projects, in all stages of progress, in this country. Some under construction, some with concessions and guarantees obtained from the National or Provincial Governments, some before the different Congresses for concessions and guarantees, and many others, where they are likely to be for an indefinite number of years, if not forever, *on paper*, or in the muddy heads of their projectors.

The principal project now in course of Congressional action, and likely to obtain the authority and endorsement asked for, is that of Messrs. Honoré of New York, and Bowen of London. This is for building about 1,200 kilometers, (750 miles) of line in this Province.

Where the money is to come from to carry out the different projects, (even if the government guarantee asked for were obtained), is of course the look-out of the projectors, but "to a man up a tree" it looks as if the limits of the faith of money lenders must soon be reached. The country is rich in soil and mineral wealth, the average climate is good and healthy (extremely hot in the northern provinces in the summer, but temperate in the middle and southern provinces,) and emigration (mostly from Italy) coming in at the rate of 70,000 to 80,000 per year.

But after several years experience and observation in Peru, Chili, Brazil and this Republic, candor compels me to say, that (except for the experience and knowledge of the world to be obtained by a residence abroad) Americans will do best for themselves, individually or collectively, by remaining in the U. S. Should a wide awake energetic young man get a definite offer of employment to come here from a responsible employer, and wishes the experience of living in "furrin parts," let him come, and he will find out the truth to which all Americans will testify, viz., that the capacity, energy and *application* necessary to make a place for himself abroad, if applied at home will give much more satisfactory results. If he has not these qualities, by all means let him not think of leaving home. He may be poor there, but that is better than being a beggar here. The application necessary in learning the language to a serviceable extent, and in a creditable manner, would, if expended in extending one's professional knowledge at home, or in taking up the study of some new branch of science, having a bearing on the material progress of the country, yield a much larger return in dollars, personal satisfaction and the respect of the people for any one recognized for his capacity and trustworthiness. By no means should any one come here on "spec" or venture, without bringing enough hard cash to see the country for a couple of months and purchase a return ticket. Professional capacity is indispensable to success here, as elsewhere, but without an acquaintance with the language, *and the business usages of the country*, one's general usefulness is sadly crippled.

I should not complain of the country for I have fared well in all places south of the Isthmus, and am now in professional employment at a salary considerably above the average for similar positions in this country. But I am preparing to leave it as soon as I can do so without causing inconvenience to my employers. I have had sufficient experience here to gratify my curiosity to see new lands, and would prefer employment in the U. S. at one half the salary. Except in the City of Buenos Aires or Rosario, educational facilities are so scant, and so expensive that it would be unwise to bring a growing family here expecting to make much progress in any education, except the study of French and Spanish.

About 18 months ago, the engines sent from Europe for the railroads of the National and Provincial Governments, were such shabby affairs, that orders were sent to the U. S. for a number. Since that time, over 50 American engines have arrived—and more are on the way—mostly Baldwin engines. If our manufacturers have delivered well made, honest work, I have no doubt that the U. S. will get the bulk of orders for such machinery hereafter.

Our car manufacturers and machine manufacturers should have a representative here in looking after their interests; one acquainted with the country and the ways of business, *and the language*. Although England can underbid us on price, yet when the superior quality and *capacity* of our products were proved by use, an extensive commerce in them should be developed. The passenger cars here, made in England or this country in imitation of American cars, are simply burlesques of them; but such as they are, they are preferred for comfort and safety in travel to the four wheeled English carriages on the same lines.

Truly yours.

* In justice I must say however that many of the officers of the road are men of conspicuous ability in their

* * *

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E. : M. INST. C. E.

(*Continued from page 143.*)

DCLXXXV. GAINESVILLE, TEX.

Gainesville, Texas, in lat. 33° 35' N., long. 97° 3' W., is the county seat of Cooke County, and is in rolling prairie country on the Elm River.

Water-works were built in 1883 and 1884 by a private company, after plans of M. C. Orton C. E., taking the supply from the river. A dam is built across the river above the city forming a large impounding reservoir the supply from which is only used in case of drouth.

The water is filtered through a crib sunk in the bank of the river, and filled with gravel, and is conducted to a pump well, from which it is pumped by two Holly steam pumps of 2,000,000 gallons daily capacity each, directly into the mains, giving an ordinary pressure of 60 lbs. and a fire pressure of 120 lbs.

Distribution is by 6 miles of cast iron pipe of 16 to 4 in. diameter, with 57 fire hydrants and 26 gates. The works were completed on March 18, 1884, and the number of taps cannot be stated. Wrought-iron will be used for service pipes. The city pays $100 yearly for each

hydrant. The population in 1880 was 2,667; it is now said to be 6,000.

The works have cost $125,000. The capital stock of the company is $100,000. Its bonded debt is $100,000 at 6 per cent for 20 years. M. D. Mather is President, and J. S. Drake, Secretary and Treasurer of the company.

DCLXXXVI. LANSDALE, PA.

Lansdale, Pennsylvania, is in lat. 40° 10′ N., long. 75° 8′ W.

Water works were built in 1883 by a private company after plans of A. K. Calhoun, the supply being taken from an artesian well, driven to a depth of 300 feet which has yielded 100,000 gallons daily without showing any signs of exhaustion. During the construction a delay of 3 months was caused by the caving in of the well which necessitated the casing of 100 feet and entailed an extra expense of $800. The water is pumped by a Deane steam pump of 5½ inch water cylinder, to a stand-pipe 8 feet in diameter and 102 feet high. Distribution is by one mile of cast iron pipe of 8 to 4 in. in diameter, with 5 fire hydrants, 3 gates, and 35 taps. Service pipes are of lead.

The town has not yet taken any action for fire protection and the hydrants are not paid for.

The population in 1880 was 798, it is now given as 1,300. The capital stock of the company is $15,000. The works have cost $15,800, and have been in operation since Dec. 1, 1883. It is expected that the works will soon be enlarged and that a bonded debt of $5,000 at 5 per cent. for that purpose will be contracted.

Wm. D. Heebner is President of the company, and John C. Booise Secretary.

DCLXXXVII. NORTH CONWAY, N. H.

North Conway, Carroll Co., New Hampshire, in lat. 44° N., long. 71° 10′ W., is on a small stream called Artist's Brook.

Water works were built in 1883 by a private company after plans of Nathan Whitaker and Lycurgus Pitman, the supply being taken from mountain springs. The water is collected in a reservoir, formed by building a stone dam 35 feet long, 8 feet high, 8 feet wide at the base, and 4 feet wide on top, having a capacity of 200,000 gallons, and an elevation of 172 feet above the village.

Distribution is by 3¾ miles of cast iron pipe of 10 to 3 inches diameter with 6 fire hydrants, 8 gates and 40 taps. The hydrants are owned by private individuals. Service pipes are of tarred wrought-iron.

The population in 1880 was 553, it is now said to be 700. The capital stock of the company is $10,000. The works have cost $10,000. There is no debt. W. M. Pitman is President of the company, and Lycurgus Pitman Secretary and Treasurer.

DCLXXXVIII. ST. CLOUD, MINN.

St. Cloud, Minnesota, in lat. 45° 33′ N., long 94° 1′ W., the county seat of Stearns County, is on the West bank of the Missouri River in a heavily timbered and rich farming district.

Settled in 1853 it was incorporated a city in 1868. Water-works were built in 1883 by the city, after plans and under the direction of Pike & Sturtevant, Civil Engineers, the supply being taken from the river. A 16 inch pipe conveys the water to a pump well 14 ft. long, 4 ft. wide and 5 ft. deep, whence it is pumped by 3 Holly pumps of 12 in. steam and 9 in. water cylinder and 12 inch stroke, having a combined capacity of 1,400,000 gallons daily, directly into the mains, and is distributed by one mile of 8 and 6 in. cast iron pipe. Service pipes are of iron.

There are 14 fire hydrants and 7 gates. The works are chiefly for fire protection and have cost $25,000.

The bonded debt is $20,000 at 6 per cent.

The population in 1880 was 2,462, it is now given as 5,000.

Wm. Bingham is the engineer.

Correction:—In our issue the numbers of the "Histories of American Water-works" (page 130) should have been as follows: DCLXXVI. RICH HILL, MO.; DCLXXVII. SANFORD, FLA.; DCLXXVIII. SAN MARCOS, TEX.; DCLXXIX. TYLER, TEX.; DCLXXX. UNIONTOWN, PA.; DCLXXXI. YANKTON, DAT.; DCLXXXII. CLEBURNE, TEX.

The Knowles Steam Pump Works correction of description of Council Bluff, Ia. Pumping Engines, should read *compound* (*not compressed*) condensing duplex, etc.

WATER.

The Smallest Water Works with which we have, in our researches, become acquainted is at Drewsville, N. H., about four miles from Bellows Falls, Vt. The village consists of a single line of houses built around the four sides of a small "common" of about two acres in extent. The population is 79; the school attendance is 13. It is the home of one of the present proprietors of the Fifth Avenue Hotel, New York City, and from its diminutive precincts have also come several other parties well known in religious, musical and commercial circles in Chicago and New York. Our family found it a pleasant and healthful place to spend the summer months in on account of its pure mountain air, delightful drives amid lovely scenery, agreeable neighborhood and its general healthfulness. The houses are supplied with pure and wholesome water, which is brought in wood pipes from a hillside spring a distance of half a mile. The Drewsville Water Company is 80 years in existence, some of the original log pipes being still in use. There are 10 shareholders. A small circular wooden well house, six feet in diameter, by about the same height, is the only structure belonging to the works. Inside this, a pile of stones without mortar is built up to sustain the "reservoir," a wooden box 2 feet by 3 feet and 2 feet deep, divided into compartments proportioned to the number of shares owned by individual takers, each share being represented by a small augur hole which allows the water to run from the common compartment into individual compartments and thence to the distribution pipes. If a "portion" of water is leased by any individual to a neighbor, it is gauged by the stem of a common clay pipe, which is the unit of measurement.

The little community is absolutely dependent on this water supply for domestic purposes. No other source of supply has been discovered, and if a "portion" cannot be obtained from a shareholder, there is no alternative but to move to some other place where water is more accessible. In 1876, new wood pipe for about the whole half mile was laid, and a new well house built, at a total expense of $282.91, which represents about the cost of maintenance of the Drewsville Water Works for three quarters of a century. The treasurer and superintendent of the company is Mr. E. C. Bond, the village postmaster and storekeeper. The principal duty of the office is to provide a safe and convenient place to hang the key of the well house.

The Fairmount street reservoir, Cleveland, O., will not be completed until next summer.

A stone falling on an exposed water main in Boston liberated a stream of water which washed away 30 feet of the Boston and Albany track and road-bed.

Dallas, Tex., has succeeded in finding a pure water supply at the City Park. No more water will be pumped from the river.

Plainwell, Michigan, is to be without water supply for two weeks, while a break in the race is being prepared.

Superintendent Bell of the Cincinnati Water-works reports the pumps badly in need of repair and the engines in a disabled state.

Petersburg, Va., has made an appropriation for improving its new reservoir in the effort to head off the threatening water famine. Water from the Upper Appomatox Canal is being run into the reservoir. All mills in the vicinity have stopped for lack of water.

Several artesian wells have recently been bored near the Red River, Dakota, and pure, soft water found in abundance at from 200 to 300 feet. Some of them have a moderate flow rising several feet above the surface.

Mason City, Iowa, is to have a system of water-works designed by Chester B. Davis, C.E., of Chicago, the estimated cost to be $40,000 and the daily supply to be 1,000,000 gallons.

Preliminary surveys are now in progress in view of establishing a system of water-works for the joint use of the towns of Laconia and Gilford, N. H. The Engineer is Almon A. Platts of Lake Village, N. H.

The extension of the third level canal of the Holyoke Water Power Company, Holyoke, Mass., is rapidly approaching completion under the contractors, John Delaney & Sons.

Newark, (N. J.) has offered to sell its water bonds, 4 per cent., thirty years to run, but not yet issued, at 101; but bankers decline to give so much, as Newark corporate 6s, can be bought at 116. The bids for the water bonds have ranged from 90 to 95.

Chicago is worried over its water supply. The figures in the case are: capacity of tunnel from crib in the lake, 150,000,000 gallons. Capacity of pumps, 134,000,000 gallons. Daily consumption from 80,000,000, to 110,000,000. With extensions at the rate of 20 miles of pipe a year this is uncomfortably near the limit of supply.

The City Government of Aurora, Ill., has authorized the issue of 4 per cent. bonds to the amount of $100,000, to defray the expense of putting in a system of water-works. A clause of the city charter forbidding the incurring of more than a debt of $5,000 in any one year threatens to give trouble. The Supreme Court will probably decide whether the issue of bonds is constitutional or not.

Kingston, Ont., Oct. 7.—The Water Works Company has offered to sell its plant to the city for a sum to be fixed by arbitration. If the city will not buy, the company propose to erect a special fire reservoir, put in new machinery, and otherwise enlarge the works if the city will withdraw $4,000 stock it holds, and thus allow the company to entirely own the works. The matter will be discussed at a special meeting of the Council.

The Marshall, Mo., waterworks now under construction will be finished by January 1. They are being built by a local corporation with $50,000 stock and a $50,000, issue of bond under a 20 years franchise, by which they are to supply the town with at least 65 fire hydrants at $75 per annum per hydrant. The noticeable feature of the works is the source of supply. A line of borings across the prairie showed that beneath 32 feet of earth, containing only surface water, there was a water bearing stratum of gravel resting on one of solid rock. This water bearing stratum is evidently the bed of a former river some two thirds of a mile in width, greatest depth 13 feet, and yields an inexhaustible supply of water.

A curb, in the shape of the frustrum of a cone 45′ 5″ in height, 33′ diameter at base and 31′ diameter at top, was built of vertical strips 3″×5″ nailed at intervals of an inch or two, upon horizontal rings with a cross section 6″×17″. The distance between these rings is 3 feet at the bottom and increases to 5 feet at the top. Upon them is built a lining of brick with no mortar between the horizontal courses. The earth within the curb is excavated and the latter sinks like a caisson by its own weight. The brick lining is built up just fast enough to keep on a level with the earth's surface, and helps to sink the curb by its additional weight. On the bottom of the wooden curb is a large iron shoe to aid it in cutting its way down. When this reaches the bed rock, the curb will remain stationary, water will percolate through the frame work and the crevices between the courses of brick in the lining; two Blake pumps will be placed on cross beams above the surface of the water, and this combination reservoir and pumping station will be complete. There is, we believe, but one other place, Burlington, N. J., where this idea has been carried out.

NEWS OF THE WEEK.

Railroads and Canals.

Work on the Chapala Railroad in the State of Jalisco, Mexico, was commenced Sept. 16.

The Minnesota and Northwestern road has completed the survey of its line into St. Paul.

The preliminary survey of the Chicago, Freeport and St. Paul line is underway.

The bridge across the Blackfork at Shelby, Ohio, fell to pieces, October 6th.

The Chicago, Burlington and Kansas City Road has been extended from Hale, Missouri, southward to Bogard, fifteen miles.

Philadelphia will invest $50,000 in asphalt pavement to be put down around the City Hall.

The South San Francisco Cable-Road Company has filed articles of incorporation. The capital stock is $500,000, with $5,000 subscribed.

The survey of the railroad in Mexico destined to connect Tapachula and the port of San Benito, will be commenced forthwith.

An electric motor running on an elevated railroad all of which is the invention of Dr. W. F. Adams of St. Louis, is among the exhibits of the exposition at that city.

The wooden coffer-dam used in repairing the leak in the Holyoke dam, contained 50,000 feet of timber and required 80 tons of stone to sink it.

The Kansas City extension of the St. Louis, Keokuk & Northwestern road will this month be completed to a connection with the Wabash at Carrollton.

Chattanooga, Oct. 2.—The Walden's Ridge railroad, a line extending 22 miles from Emory Gap, on the Cincinnati Southern, to the coal fields, was opened formally to-day.

Grading on the Franklin and Megantic Railroad in Maine, will be completed in two weeks. It is expected that the road will be in condition for business by the end of November.

THE Pittsburgh Junction Railroad was completed and tested, September 25th. It is five miles, and connects the Baltimore and Ohio with the Pittsburgh and Western.

THE surveying party on the Anniston & Cincinnati Railroad had reached Sulphur Springs, Calhoun County, Ala., when last heard from, Mr. Hardaway is in charge.

GRADING on the St. Johns and Lake Eustis Railroad has been completed to within a short distance of Leesburg, Fla., and it will not be long before the iron is laid and the cars running.

THE railroad surveyors of the Plant Line are surveying their line three miles east of the Washington line, and they are now south of Fort Green, Fla., en route to Charlotte Harbor via Pine Level.

TWENTY-SEVEN hundred men are at work on the Philadelphia branch of the B. & O. Eighty per cent. of the work is done. The line is 95 miles in length.

THE West Shore to have a double track in excellent condition in full working order to Syracuse by Nov. 15th next. The company needs about $2,000,000 to complete a double track to Buffalo, depots, etc.

THERE are rumors afloat that a narrow gauge road will be constructed from Lake Jessup to Altamonte and possibly to Apopka, Fla. The T., O. and A. road has sixty graders now at work near Zellwood, coming toward Apopka.

THE grading of the Leesburg branch of the St. Johns and Lake Eustis Railroad of Florida is nearly completed to Leesburg, and the building of the bridge across the Ocklawaha River at Orange Bend is rapidly advancing toward completion.

THE Western Iowa Railroad has filed articles of incorporation, capital $3,000,000. Incorporators, J. S. Cameron, W. W. Baldwin, and others. Route, from Adair County to Pottawattamie County, Iowa.

APPLICATIONS have been made at Kansas City, for an injunction to prevent further construction of the Kansas City, Clinton and Springfield Railroad, which is designed to complete with the Kansas City, Fort Scott and Gulf Railroad.

THE government of Zacatecas, has authorized Dr. Juan Brena to construct a railroad between Zacatecas and the Veta Grande mining district, with the corresponding branches to unite with the Guadalupe line and the reduction works. The work on this line will be commenced forthwith.

HARRISBURG, Oct. 7.—A charter was granted to-day to the Somerset County Railroad Company, the main office of which is at Confluence, Somerset County. The capital is $2,000,000, and the length of the road contemplated is twenty miles. It will run from Confluence to Somerset.

A COMPANY of Baltimore capitalists have organized a company to build an elevated railroad between St. Paul and Minneapolis. The cost of construction will not exceed $1,000,000. Within city limits the road bed will have an elevation of 16 feet, with a light plank floor and side screens 6 feet high. Outside of city limits it will become a surface road.

BALDRIDGE, Penn., October 6th.—A six inch pipe line will soon be laid by the National Transit Company from their station a Bear creek to this field which promises a large daily production within the next two months. Engineers have surveyed the route and rights of way are being obtained. The line will be about sixteen miles long.

PITTSBURG, Pa., Oct. 6.—A number of prominent railroad men and capitalists, including W. P. Hubbard, Samuel Merrill and Wm. Philips, of New York, and W. C. Mebley, H. A. Schwanecke and W. P. Howland, of this State, will meet here on the 15th inst., to complete arrangements of the construction of an air line, twelve hundred miles long, which will connect New York with Chicago, Council Bluffs and St. Louis.

SPRINGFIELD, Ill., Sept. 25.—The Springfield, Shelbyville and Mount Carmel Railroad company to-day filed articles of incorporation with the secretary of State, with a capital stock of $2,000,000. It is proposed to construct said railroad from Springfield through Shelbyville to Mount Carmel, in Wabash county. The first board of directors are Thomas M. Thornton, George Chafee, Anthony Thornton, P. M. Howard, E. H. Bishop, Robert Bell, Charles Ridgely, J. C. Bell, John Mason; mostly all of Shelbyville.

THE engineer's profile of the Indianapolis, Eel River and Western road shows that there will be 2100 feet of bridges to build and 6500 feet of trestle work. In the construction of the road 2800 cross-ties to the mile will be put in, and a 60-pound-to-the-yard steel rail, Twenty-seven miles of steel rails have already been purchased.

THE preliminary survey of the Memphis and Yazoo City Railroad, the line which the Illinois Central is to build, was commenced Sept. 27th, at a point on the Mississippi state line a few miles from Horn Lake, because the company, incorporated under the laws of Mississippi, has not yet obtained a charter from Tennesee. Capt. H. Mann, Division Superintendents of the Illinois Central, Jackson, Tenn., who is in charge of the work, expects to complete the survey in two months time, when grading will be commenced.

THE *Pittsburgh Dispatch* of October 7th, contains the following: "Williamsport, October 6th.—There is great excitement in the bituminous coal country about the disappearance of W. P. Norton and James Welsh, two subcontractors employed by the constructors of the Beech Creek, Clearfield and Southwestern Railroad. They were building a road penetrating the country where the mines of the Clearfield Bituminous Coal Company are located, and had between five hundred and eight hundred Hungarian and Italian laborers working for them, whom they owed two months' wages. They promised to pay the men on October 1st. Under pretense of going to Clearfield and drawing the money from the bank, Norton and Welsh left Bigler and proceeded to Clearfield and removed their deposits, amounting to between $18,000 and $19,000, and left for parts unknown."

Miscellaneous.

TRAINS began running over the Lake Pontchartrain bridge again, Oct. 3. The exact length of the bridge burnt was 3,990 feet.

EAU CLAIRE has voted to bond itself to the extent of $40,000, in order to erect three new bridges across the river at that point.

THE following is an abstract for improving Snake river between Lewiston, I. T., and Riparia, W. T.:

Holmes & Spencer, $7,494.
Smith & Kittenbach, $27,407.
Contract awarded to Holmes & Spencer.

THE following are the bids for putting up the new library building of the Young Men's Association at Buffalo, N. Y. J. Beier & Son, $13,250; Schmidt Brothers, $13,500; Rumrill & Rupp, $14.250; John Druar, $14,719; Charles Berrick, $14,995; J. H. Tilden, $15,266; W. R. & W. Haven, $24,543. The contract was given to J. Beier & Son, as the lowest bidders. The 24th of December is the date specified for the completion of the contract.

THE following is an abstract for the proposals for dredging Raritan Bay, N. J.:

P. Sanford Ross, Jersey City, N. J., 18 7-10c. per cubic yard.
Thomas Potter, Jersey City, 16¾c. per cubic yard.
Atlantic Dredging Company, Brooklyn, N. Y., 16c. per cubic yard.
Morris & Cummings Dredging Company, New York city, 16c. per cubic yard.
The contract has been awarded to the Atlantic Dredging Company.

THE following is an abstract of proposals for dredging in harbor at Muscatine, Iowa:

A. J. Whitney, Keokuk, Iowa, 10c. per cubic yard.
H. S. Brown, Quincy, Ill., 15c.
C. S. Whitney, Keokuk, Iowa, 17c.
C. H. Appleton, La Crosse, Wis., 16 2-3c.
C. L. Williams, Keokuk, Iowa, 13c.
The contract has been awarded to A. J. Whitney.

COPELAND & BACON have received contract for complete plant of special hoisting machinery to be used in the construction of the new Cantilever Bridge at St. Johns.

This firm make a specialty of hoisting machinery in all forms, designing their machinery always for the work to be done.

They are also busy on a hoisting plant for the Haile Gold Mining Co. of South Carolina and have just completed a large plant of ore washing and hoisting machinery for the Low Moor Iron Co., and are also busy on plants for other new works.

BY direction of the Common Council of Cleveland, Ohio, the city engineer has prepared plans and estimates for a bridge across the Cuyahoga River at a point about midway between the passenger bridge, of the C., C., C, & I. Railway, and the foot bridge of the same company and opposite Short Street. The plan provides for a 250 foot iron swing bridge, on a center pier located near the left bank of the river giving one clear channel of 95 feet and one narrow channel of about 36 feet after the dock line opposite the bridge is straightened. Estimated cost exclusive of right of way $52,000.

THE following is an abstract of proposals received by Major A. Mackenzie, Corps of Engineers, for constructing a dam and shore protection of brush and stone at Andalusia, Ills. Patterson Bros. Keokuk, Iowa, 1. 5,000 cubic yards of stone, at $1.40 per cubic yard; 2. 4,000 cubic yards of brush, at 65c. per cubic yard.

Daniel Kelcher, Davenport, Iowa; 1. at $1.75; 2. at $1.40; J. W. Heisey, Burlington, Iowa; 1. at $1.70; 2. at $1.00; Fruin, Bambrick & Co., St. Louis, Mo.; at $1.90; 2. $1.10; C. S. Whitney, Keokuk, Iowa; 1. $1.35; 2. 85c.; A. J. Whitney, Keokuk, Iowa; 1. $1.25; 2. 70c.

THE following is an abstract of proposals, opened by Capt. E. H. Ruffner, Corps of Engineer, for constructing dams and shore protections of brush and rock, in the vicinity of Louisiana, Mo. Fruin, Bambrick & Co., St. Louis, Mo.; 1. 10,000 cubic yards of stone, at $1.49; 2. 8,000 cubic yards of brush, at 80c.; H. McPherson & Co., Boonville, Mo.; 1. $1.49; 2. 85c.; C. S. Whitney, Keokuk, Iowa; 1. $1.35; 2. 90c.; A. J. Whitney, Keokuk, Iowa; 1. $1.49 2. 80c. H. S. Brown, Quincy, Ill.; 1. $1.40; 2. 91c.; Patterson Bros. Keokuk, Iowa; 1. $1.35; 2. 65c.

THE following is a description of the bridge now building over the Brandywine river, on the outskirts of Willimington, for the Philadelphia branch of the Baltimore and Ohio Railroad. There are five piers, three of which will be eighty-two feet high. The other two will have a height of forty feet. At the base they are each thirty-seven feet seven and a-half inches long, and have a uniform width of fourteen feet seven and a-half inches. At the top they are thirty-two feet long, including the coping, and eight feet wide. In each pier there are four through stones ten feet long. The iron work will be twenty-six feet above the stone coping. The longest span will be 164 feet. The entire length of the bridge will be 874 feet.

AN electric light-house has lately been erected on the island of Raza, at the entrance to the Bay of Rio Jeneiro. The light-house proper is 85 feet in height, and is built upon a rock 230 feet in height; so that the focus of the light of the apparatus is fixed at a total elevation of 315 feet above the sea. The electric current is produced by a continuous-current Gramme machine, working at the rate of 700 revolutions, and feeding a light rated to be of 2,000 candle power. The Gramme machine mentioned is worked by a stationary surface condensing steam engine, such arrangement being rendered obligatory, owing to the lack of fresh water. All the fittings are double, so as to prevent interruption by unforseen accidents; still, to render positive certainty, oil lamps of high lighting power are always kept in readiness. The light is of the revolving class, having two white discs and one red, succeeding one another at intervals of 15 minutes. It is asserted that, on clear nights, the light is visible at a distance close on to 35 statute miles; but the general efficacy of the system is tremendously impaired during foggy weather.

THE bridge which is being built for the Wisconsin Central, four miles east of Stillwater, Minn., will be 2340 feet in length and built entirely of iron, resting on stone piers. There are nine piers, each resting on piling driven into the river bed about 15 feet until rock is reached. On the piles is placed a layer of white-oak timbers 10 inches square, firmly fastened together, the masonry resting upon these. The piers, nine in number, are 34 feet 6 inches by 11 feet 10 inches at the bottom, 20 feet by 6 at the top, and about 46 feet high above low water mark. The nine iron spans average about 159 feet in length, the channel span being somewhat longer than the others. The trestle approach on the Wisconsin side is to be of iron resting on square stone piers, of which there are twenty-five pairs. Six of the piers are already completed, the seventh nearly so, and the caissons for the other two ready to place in position. The superstructure will be entirely of iron, the bottom of the channel span being 82 feet above low water mark, thereby obviating the necessity for draw. The bridge was to be completed by the 10th of October. It is being erected by the Union Bridge Company of Buffalo, N. Y., the builders of the new cantilever bridge below Niagara Falls.

THE people of Monroe, La., are pushing the project of a railroad along the Ouachita River.

THE following is an abstract of the bids for removing solid rock cobble stone and gravel from the channel of Snake River, Oregon and Washington Territory, between Walker Landing and the mouth of the river:

Holmes & Spencer, Portland, Oreg., $14,970.
Smith & Kittenbach, Lewiston, Idaho, $35,910.
L. R. Smith, Lewiston, Idaho, $13,975.
Contract awarded to L. R. Smith.

THE following is an abstract of the bids for improving Passaic River, N. J., above Newark.

J. H. Staats, Jersey City, N. J., 55c. per cubic yard.
John McDermott, 68c. per cubic yard.
Morris & Cummings Dredging Co., 54c. per cubic yard.
Richard Parrott, 49c. per cubic yard.
Frank Pidgeon, 57c. per cubic yard.
Contract awarded to Richard Parrott.

THE following is an abstract of the bids for dredging in the Merrimac River, Mass.:

John McDermott, Cohoes, N. Y., $2.18 per cubic yard; for removing boulders over six tons in weight, $19 per cubic yard.
Boynton Bros., Mass., $2.50 per cubic yard; boulders $2 per cubic yard.
Thomas Symonds, Leominster, Mass, $2.50 per cubic yard; boulders, $15 per cubic yard.
A. B. Martin, Boston, Mass., $3.50 per cubic yard; boulders, $10 per cubic yard.
Contract awarded to John McDermott.

THE following is an abstract of the bids on account of the improvement of San Joaquin River and Stockton and Mormon sloughs:

Edward W. Emerson, San Francisco; 1. Stockton slough, 60,000 cubic yards at 25c.; 2. Mormon slough, 25,000 cubic yards at 25c.; 3. San Joaquin River, 15,000 cubic yards at 25c. Total, $25,000.
Thomas H. Williams, Jr., Undine, San Joaquin County, Cal.; 1. 22c.; 2. 30c.; 3. 15c. Total, $22,950.
J. H. McNee and Edward A. Van Schmidt, San Francisco; 1. 17 49-100c.; 2. 17 49-100; 3. 17 49-100c. Total, $17,490.
The bid of McNee and Van Schmidt had been accepted.

THE following is an abstract of the bids for supplying wrought-iron beams to the Ordnance Depot at Rock Island arsenal:

A. & P. Roberts & Co., Philadelphia, Penn., $15,528.75.
New Jersey Steel and Iron Company, Trenton, N. J., $16,091.05.
Phœnix Iron Company, Philadelphia, Penn., $15,536.36.
Passaic Rolling Mill Company, Patterson, N. J. $15,544.84.
Carnegie Bros. & Co., Pittsburgh, Penn., $15,559.11.
Pottsville Iron and Steel Company, Pottsville, Penn., $15,537.96.
Jones & Laughlin, Chicago, Ill., $14,403.88. This firm failed to bid on several articles.
The contract has been awarded to A. and P. Roberts & Co.

THE following is an abstract of the bids for dredging in Plymouth Harbor.

George E. Runyon, Boston, Mass., 16½c. per cubic yard; $6 per cubic yard for removing boulders of six tons in weight.
Augustus B. Martin, Boston, Mass., 20½c. per cubic yard; $5 per cubic yard for removing boulders weighing over six tons.
Robert Hamilton, Jr., Chebeaque, Me., 21c. cubic yard, and $10 per cubic yard for the boulders.
John McDermott, Cohoes, N. Y., 22c. per cubic yard; and $8 for boulders.
Boynton Bros,, Boston, 23c. per cubic yard, and $2 for boulders.
The contract has been awarded to George E. Runyon.

THE following is an abstract of the bids for rip-rap granite for extending the Greenport breakwater, N. Y:

James Scully, Groton, Conn., $1.34 per ton; $9.730 for 7,000 tons.
Francis H. Smith, New York, $1.44 per ton; $10,080 for 7,000 tons.
Charles H. Edwards, Boston, Mass., $1.38 per ton; $9,660 for 7,000 tons.
A. J. Howell, New York, $2.21 per ton; $15,470 for 7,000 tons.
William H. Molthrop, Gale's Ferry, Conn., John T. Tank, Providence, R. I., and Benjamin Stark, New London, Conn., $1.64 per ton; $11,480 for 7,000 tons.
C. D. Allen, Westfield, Mass., $1.64 per ton; $11,480 for 7,000 tons.
John Beattie, Leetes Island, Conn., $1.52 per ton; $10,640 for 7,000 tons.
The contract has been awarded to Chas. H. Edwards.

SPEZIA, Oct. 3.—Experiments with a 100 ton gun, with a charge of powder weighing 350 pounds were made to-day. The projectile penetrated the Schneider armor-plate of hammered steel, the compound Kummell and the compound Brown plate. The Schneider plate was broken into three, the Brown plate into four and the Kummel plate into six pieces.

THE following is an abstract of the bids for dredging in Providence River:

Atlantic Dredging Co., Brooklyn, N. Y., 12c. per cubic yard.
Henry Du Bois' Sons, New York, 12c. per cubic yard.
P. Sanford Ross, Jersey City, N. J., 14c. per cubic yard.
J. Boynton, Newport, R. I., and Lyman Boynton, Boston, Mass., 14c. per cubic yard.
National Dredging Co., Wilmington, Del., 14 9-10c. per cubic yard.
Moore and Wright, Portland, Me., 15c. per cubic yard.
George C. Fobes & Co., Baltimore, Md., 15½c. per cubic yard.
Col. Elliott, in his recommendations to the Chief of Engineers regarding the award on this work, advises that the contract be made with the Atlantic Dredging Company. The Chief of Engineers has written him to have the two lowest bidders decide between themselves as to who shall take the contract. The matter will probably be decided by lot.

THE following is an abstract of the proposals opened at New Orleans by Captain Turtle, for the removal of wrecks in the harbor at New Orleans. All the bids have been rejected. The work may be re-advertised, but it is more probable that new bids will be called for by circular letter:

Eben Margan Stoddard, Norfolk, Va.—Steamship Gresham: removal, $33.000; purchase, $3,000. Ship Ailsa: removal, $9,500; purchase, $500. Steamship General Grant: removal, $10,500; purchase, $500. Peter E. Falcon, Chicago, Ill.—Gresham: removal $25,000, purchase, $1,000.
American Dredging Company, Philadelphia, Pa.:—Gresham: removal, $28,000; purchase, $8,000. Ailsa: removal, $13,000; purchase, 3,000. General Grant: removal $10,000; purchase, $2,000.
Atlantic and Gulf Wrecking Company, Summers Point, N. J.:—For removal of all three wrecks, $44,500. Purchase and removal of three wrecks. $39,500. Edward R. Lowe, New York city:—Gresham: removal, $22,375; purchase, $3,000. Ailsa: removal, $11,000; purchase, $500. General Grant: removal, $13,000; purchase, $2,000.
W. E. Buck and E. H. Burris, New Orleans, La.:—Ailsa; removal, $13,000. Rittenhouse, Moore, Mobile, Ala.:—Will remove all three wrecks for $19,500 and give $300 for the three wrecks.
Woodward, Wight and Mackie, New Orleans, La.:—Gresham: removal, $25,900; purchase, $2,590. Ailsa: removal, $14,030; purchase, $1,400; General Grant; removal, $12,840; purchase, $1,280.

THE following is an abstract of the proposals for improving Passaic River below Newark, N. J.:

Morris & Cummings Dredging Company, New York City. Dredging, 20c. per cubic yard; dike, $27 per lineal foot.
Richard Parrott, Newburgh, N. Y., Dredging, 26c.; dike, $24 per lineal foot.
John S. Howell, 336 West Nineteenth street, New York City. No bid on Dredging; dike, $51.97 per lineal foot.
Waldo Danforth, Bergen Point, N. J., Dredging, 15½c. per cubic yard; dike, $22.75 per lineal foot.
Brainard & Benton, 20 Coentis Slip, New York City. Dredging, 18 1-2c. per cubic yard; dike, $16.75 per lineal foot.
Henry DuBois' Sons, 119 South street, New York. Dredging 10c. per cubic yard; dike, $18 per lineal foot.
Stephen A. Kelly, 14 Atlantic Avenue, Brooklyn, N. Y., Dredging, 17c. per cubic yard; dike, $19 per lineal foot.
Edward M. Payn, Albany, N. Y., Dredging, 21½c. per cubic yard; dike, $24,90 per lineal foot
Frank C. Somers, 302 South Delaware avenue, Philadelphia. Dredging, 19c. per cubic yard; dike, no bid.
Wm. H. Morton, Eastchester, N. Y. Dredging, 24c. per cubic yard; dike, $10 per lineal foot.
Thomas Potter, Jersey City, N. J. Dredging, 24c. per cubic yard; dike, $24.50 per lineal foot.
Frank Pidgeon, 116 Wall street, New York. Dredging, 17c. per cubic yard; dike, $25.91 per lineal foot.
The contract has been awarded to Henry DuBois' Sons. The lowest bid was determined on estimate for 600 feet of dike.

WORK will be commenced immediately on a bridge across the Tennessee at Chattanooga, to cost $300,000.

THE following is an abstract of the proposals for rubble stone for jetties in Newburyport Harbor, Mass.:

Charles H. Edwards, Boston, Mass., $1.58 per ton of 2,240 pounds.
Cape Ann Granite Co., Boston, $1.79 per ton
Parker & Sylvester, Boston, $1.84 per ton.
Davis Tillson, Rockland, Me., $1.90 per ton.
Joseph H. White, Hyde Park, Mass., $1.93 per ton.
Newburyport Quarry Co., Newburyport, Mass., $2.13 per ton.
Thomas A. Rowe, Newton Center, Mass., $2.19 per ton.
The contract has been awarded to Charles H. Edwards.

THE following is an abstract of the proposals for dredging in Newport harbor, R. I.:

Hartford Dredging Company, Hartford, Conn., 19c. per cubic yard.
Augustus B. Martin, Boston, Mass., 25½c. per cubic yard.
J. H. Fenner, Jersey City. N. J,, 22 9-10c. per cubic yard.
P. Sanford Ross, Jersey City, N. J., 28½c. per cubic yard.
John McDermott, Cohoes, N. Y., 29c. per cubic yard.
J. Boynton, Newport, and Lyman Boynton, Boston, 30c. per cubic yard.
Richard M. Payn, Albany, 34½c. per cubic yard.
Moore & Wright, Portland, Me., 35c. per cubic yard.
Brainard and Benton, New York city, 35c. per cubic yard.
H. N. and A. J. Beardsley, Bridgeport, Conn., 40c. per cubic yard.
The contract has been awarded to Hartford Dredging Company.

The following is an abstract of proposals for dredging in Pawtucket river, R. I.

Brainard & Benton, New York city, 21c. per cubic yard.
Atlantic Dredging Company, Brooklyn, N. Y., 21½c. per cubic yard.
P. Sanford Ross, Jersey City, N. J., 21½c. per. cubic yard.
National Dredging Company, Wilmington, Del., 21 9-10c. per cubic yard.
George C. Fobes & Co., Baltimore, Md., 23c. per cubic yard.
Moore & Wright, Portland, Me., 24c. per cubic yard.
J. Boynton, Newport, R. I, and Lyman Boynton, Boston, Mass., 26c. per cubic yard.
John McDermott, Cohoes, N. Y., 26c. per cubic yard.
Richard M. Payn, Albany, N. Y., 26½c. per cubic yard.
Contract awarded to Brainard & Benton.

THE following is a list of the proposals received and opened at noon, on September 25, 1884, by General M. C. Meigs, supervising engineer and architect, for iron work for roofs over the new Pension building in Washington, D. C.

C. A. Schneider & Sons, Washington, D. C. $59,393.
Fort Pitt Steam Boiler and Bridge Works, Pittsburg, Pa., $49.489.
Riverside Bridge and Iron Works, Patterson, N. J., $44,444.
Phœnix Iron Company, Trenton, N. J., $48,875.
Cheney & Hewlett, New York, $65,000.
Penn Bridge Works, Beaver Falls, Pa., $44,375.
Post & McCord, New York, $59,844.
New Jersey Steel and Iron Co., Trenton, N. J., for roof-over office rooms 3½c. per pound, and for roof over court yards, 5 4-10c. per pound.
Snead & Co., Iron Works, Louisville, Ky., $54,987.
Pittsburg Bridge Company, Pittsburg, Pa., $39.492.
Passaic Rolling Mill Company, Paterson, N. J., $48,833.
Keystone Bridge Company, Pittsburg, Pa., $58,548.
D. W. C. Carroll & Co., Pittsburg, Pa., $51,000.
King Iron Bridge Company, Cleveland, Ohio, $47,000.
Haugh, Ketcham & Co., Indianapolis, Ind., $47,838.
The following bids were received after 12 o'clock, on the 25th inst.:
The Schiffler Bridge Works, Pittsburg, Pa., $47,400.
The Union Foundry and Pullman Car Wheel Works, Chicago, Ill., $58.227.
The contract has been awarded to the Pittsburg Bridge Company.